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# (54) DEVICE FOR MONITORING LIVESTOCK AND METHOD FOR MONITORING DELIVERY OF LIVESTOCK

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a livestock-monitoring device capable of reducing monitoring load accompanied by delivery, etc., of livestock and surely and early informing sign of the delivery, etc.

SOLUTION: This livestock-monitoring device A is used for raising an alarm in response to action of a horse in a racing stable and is equipped with an image sensor G for catching image of the horse and processing the image, a CPU 10 for outputting alarm signal in response to image signal and picturing signal from the image sensor G and an interface circuit 14 for sending the alarm signal outputted from the CPU 10 through a signal cable C1 to an alarm unit.

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## CLAIMS

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[Claim(s)]
[Claim 1]A livestock monitoring instrument characterized by comprising the following for emitting an alarm according to operation of livestock in a barn.
An image sensor which catches and processes a picture of the above-mentioned livestock.
A control circuit which outputs an alarm signal according to a signal from a described image sensor, and a communication circuit which sends an alarm signal outputted from the above-mentioned control circuit out of this device, and tells it.

[Claim 2]The livestock monitoring instrument according to claim 1 in which a described image sensor outputs an imaging signal which can specify the above-mentioned livestock as a movable matter object, and a picture signal which can specify the above-mentioned livestock as a static object.
[Claim 3]The livestock monitoring instrument according to claim 2 provided with an interface circuitry for transmitting the above-mentioned imaging signal and/or a described image signal from a described image sensor to computer paraphernalia besides this device as imaging data and/or image data.
[Claim 4]The livestock monitoring instrument according to claim 2 or 3 provided with a storage device for memorizing the above-mentioned imaging signal and/or a described image signal from a described image sensor in this device as imaging data and/or image data.
[Claim 5]The livestock monitoring instrument according to any one of claims 2 to 4 provided with an interface circuitry for transmitting the above-mentioned imaging signal and/or a described image signal from a described image sensor to a monitoring device besides this device as a video signal.

[Claim 6]The livestock monitoring instrument according to any one of claims 1 to 5 provided with a radio unit which transmits a signal or data by radio out of this device.
[Claim 7]The livestock monitoring instrument according to any one of claims 2 to 6 in which a described image sensor removes background parts other than the above-mentioned livestock from a described image signal based on the above-mentioned imaging signal.
[Claim 8]The livestock monitoring instrument according to any one of claims 1 to 7 attached to a ceiling and/or a wall surface in the above-mentioned barn. [ two or more ]
[Claim 9]The livestock monitoring instrument according to any one of claims 1 to 8 provided with an infrared sensor which detects the above-mentioned livestock with infrared rays.
[Claim 10]The livestock monitoring instrument according to any one of claims 1 to 9 provided with a light source for illuminating the above-mentioned livestock.
[Claim 11]The livestock monitoring instrument according to claim 10 provided with an automatic regulation circuit which adjusts a luminosity of the above-mentioned light source according to a surrounding luminosity.
[Claim 12]The livestock monitoring instrument according to any one of claims 2 to 11 with which picture number of sheets obtained one by one based on a described image signal is in inverse proportion to movement quantity of the above-mentioned livestock measured based on the above-mentioned imaging signal proportionally.
[Claim 13]The livestock monitoring instrument according to any one of claims 2 to 12 which restricts the above-mentioned control circuit when movement quantity of the above-mentioned livestock measured based on the above-mentioned imaging signal is below a minimum set value or beyond a maximum set value, and outputs the above-mentioned alarm signal.
[Claim 14]The livestock monitoring instrument according to claim 13 in which a preset value alteration means for changing the above-mentioned minimum set value and a maximum set value is provided in the above-mentioned control circuit.
[Claim 15]The livestock monitoring instrument according to claim 13 or 14 to which the above-mentioned control circuit will change the above-mentioned alarm signal if predetermined time passes since a time of movement quantity of the above-mentioned livestock becoming below the above-mentioned minimum set value or beyond a maximum set value.
[Claim 16]The livestock monitoring instrument according to any one of claims 13 to 15 which shall be different in the above-mentioned alarm signal by a case where the above-mentioned control circuit is beyond a case where movement quantity of the above-mentioned livestock is below the above-mentioned minimum set value, and a maximum set value.
[Claim 17]The livestock monitoring instrument according to any one of claims 1 to 16

which has a gain-adjustment means which carries out the gain adjustment of the storage time of a picture according to this average input value while computing an average input value from the whole pixel of a described image sensor.

[Claim 18]The livestock monitoring instrument according to any one of claims 1 to 17 which has an input sensitivity adjustment device for adjusting input sensitivity of a described image sensor.

[Claim 19]The livestock monitoring instrument according to any one of claims 1 to 18 which outputs the above-mentioned alarm signal so that it may have an odor sensor which detects a bad smell of the above-mentioned livestock and the above-mentioned control circuit may tell delivery signs of the above-mentioned livestock based on both signals from a described image sensor and the above-mentioned odor sensor.

[Claim 20]A delivery monitor method of livestock telling with an alarm that livestock is in delivery signs using the livestock monitoring instrument according to any one of claims 1 to 19.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to a livestock monitoring instrument and the delivery monitor method of livestock excellent in catching the delivery signs of livestock especially about the art for supervising livestock, such as a horse bred in a stable, for example, a cow, an animal bred widely in the zoo etc.

[0002]

[Description of the Prior Art]For example, although a racehorse is bred for the purpose of improvement of ****, and promotion of a zootechnics, a form, a body, and a disposition required to demonstrate the full-speed-running capability to have excelled are required, and it is made common [ crossing specific **** and being produced ]. To be certain and safe is demanded, therefore the stable keeper is having the mare supervised in organization every day for 24 hours at a delivery stage from a considerable investment of seed attachment expense etc. following on the delivery of such a racehorse.

[0003]By the way, that it is forced a burden equivalent to always supervising a mare, and a delivery begins at a stage earlier than an estimated due date of delivery or the overdue stage from a certain thing. A video camera is attached in a stable and there is also a place projects on the monitoring device of a monitoring station the action of the mare caught with this video camera, and he is trying to supervise it. In these days, the characteristic bad smell accompanying a delivery is detected and there is also a place which has adopted as a monitoring station the system of reporting it being delivery nearness. Thereby, the stable keeper can stand by in a monitoring station until the signs of childbirth appear, and the burden is eased a little.

[0004]

[Problem(s) to be Solved by the Invention]However, the stable keeper periodically or always has to observe the appearance of a mare through the monitoring device of a monitoring station as organization supervised using a video camera and a monitoring device, and a monitoring load was not necessarily thoroughly wiped away for the stable keeper.

[0005]Although the smell of the amniotic liquid which flows out by amniorrhexis etc. is detectable in the system which detects the bad smell accompanying a delivery and, on the other hand, reports that it is delivery nearness, Since there is almost no difference in the strength of the bad smell emitted by becoming delivery nearness, and the strength of the bad smell at the time of usual until an amniotic liquid outflow etc. take place, there is a possibility of overlooking the signs of the delivery in an early stage. In order to make into a detection object the bad smell which drifts the inside of the air, there was a possibility of causing malfunction also in response to smells other than a mare, and certain and the difficulty that the signs of childbirth could not be caught were at an early stage from these points.

[0006]The above-mentioned device and system are applicable not only the delivery of a racehorse but in order to supervise childbirth, illness, etc. about the horse as livestock in a narrow sense, a cow, the animal bred in the zoo etc. if it interprets still more widely, etc., but a problem which carried out point ** anyway shall produce them.

[0007]

[Description of the Invention]This invention makes it the technical problem certain and to provide the livestock monitoring instrument which can be told at an early stage, and the delivery monitor method of livestock for signs, such as the delivery, while it is invented under the above-mentioned circumstances and eases the monitoring load accompanying the delivery of livestock, etc.

[0008]In order to solve the above-mentioned technical problem, the following technical means are provided in this invention.

[0009]Namely, the image sensor which according to the 1st side of this invention is a livestock monitoring instrument for emitting an alarm according to operation of the livestock in a barn, and catches and processes the picture of livestock, A livestock monitoring instrument provided with the control circuit which outputs an alarm signal according to the signal from an image sensor, and the communication circuit which sends the alarm signal outputted from the control circuit out of this device, and tells it is provided.

[0010]According to the desirable embodiment, an image sensor outputs the imaging signal which can specify livestock as a movable matter object, and the picture signal which can specify livestock as a static object.

[0011]According to other desirable embodiments, it has an interface circuitry for transmitting the imaging signal and/or picture signal from an image sensor to the computer paraphernalia besides this device as imaging data and/or image data.

[0012]Furthermore, according to other desirable embodiments, it has a storage device for memorizing the imaging signal and/or picture signal from an image sensor in this device as imaging data and/or image data.

[0013]Furthermore, according to other desirable embodiments, it has an interface circuitry for transmitting the imaging signal and/or picture signal from an image sensor to the monitoring device besides this device as a video signal.

[0014]Furthermore, according to other desirable embodiments, it has a radio unit which transmits a signal or data by radio out of this device.

[0015]Furthermore, according to other desirable embodiments, an image sensor removes background parts other than livestock from a picture signal based on an imaging signal.

[0016]Furthermore, according to other desirable embodiments, more than one are attached to the ceiling and/or wall surface in a barn.

[0017]Furthermore, according to other desirable embodiments, it has an infrared sensor which detects livestock with infrared rays.

[0018]Furthermore, according to other desirable embodiments, it has a light source for illuminating livestock.

[0019]Furthermore, according to other desirable embodiments, it has an automatic regulation circuit which adjusts the luminosity of a light source according to a surrounding luminosity.

[0020]Furthermore, according to other desirable embodiments, the picture number of sheets obtained one by one based on a picture signal is in inverse proportion to the movement quantity of the livestock measured based on an imaging signal proportionally.

[0021]Furthermore, according to other desirable embodiments, a control circuit is restricted when the movement quantity of the livestock measured based on an imaging signal is below a minimum set value or beyond a maximum set value, and it outputs an alarm signal.

[0022]Furthermore, according to other desirable embodiments, the preset value alteration means for changing a minimum set value and a maximum set value is provided in the control circuit.

[0023]Furthermore, according to other desirable embodiments, a control circuit will change an alarm signal, if predetermined time passes since the time of the movement quantity of livestock becoming below a minimum set value or beyond a maximum set value.

[0024]Furthermore, according to other desirable embodiments, control circuits shall differ an alarm signal by the case where it is beyond the case where the movement quantity of livestock is below a minimum set value, and a maximum set value.

[0025]Furthermore, according to other desirable embodiments, while computing an average input value from the whole pixel of an image sensor, it has a gain-adjustment means which carries out the gain adjustment of the storage time of a picture according to this average input value.

[0026]Furthermore, according to other desirable embodiments, it has an input sensitivity adjustment device for adjusting the input sensitivity of an image sensor.

[0027]Furthermore, according to other desirable embodiments, it has an odor sensor which detects the bad smell of livestock, and based on both the signals from an image sensor and an odor sensor, a control circuit outputs an alarm signal so that it may tell the delivery signs of livestock.

[0028]According to the 2nd side of this invention, the delivery monitor method of livestock telling with an alarm that livestock is in delivery signs using the above-mentioned livestock monitoring instrument is provided.

[0029]That is, according to this invention, if livestock begins the characteristic operation which shows delivery signs etc., a different signal from usual will be outputted from the image sensor which regarded the livestock as a picture, and an alarm signal will be told out of a device according to it. Therefore, since the delivery signs of livestock, etc. will be reported by a sound, light, etc. if the alarm is installed in the monitoring station etc. which become the outside of a device and this alarm receives an alarm signal, While always not patrolling a stable when giving birth to livestock etc. and being able to ease a monitoring load, signs, such as the delivery, can be told at certain and an early stage.

[0030]The image sensor can regard certainly a motion of the livestock seen as signs, such as childbirth, as a different thing from usually, if an imaging signal and a picture signal shall be outputted. If imaging data and image data are transmitted to computer paraphernalia, a motion of livestock can be mostly checked in real time on computer paraphernalia. If imaging data and image data are memorized to the storage device, even if it always does not start computer paraphernalia, imaging data and image data can be taken out if needed, and a motion of livestock can be checked periodically. If a video signal is transmitted to a monitoring device, a motion of livestock can be mostly checked in real time via the monitoring device. If such a signal and data shall be transmitted by radio, the time and effort of wiring can be saved.

[0031]The image sensor can catch livestock with a motion certainly, if it should have the movable matter object extract function of removing background parts other than livestock without a motion. If two or more these devices are attached to the ceiling and wall surface in a barn, even if it is in the situation where a motion of livestock cannot be correctly caught with a device, temporarily [ while ], a motion of livestock can be correctly caught from the device side of another side. If livestock is detected by an infrared sensor, it can restrict, while this infrared sensor is detecting livestock, and an image sensor can be operated, and power-saving can be attained. If it should have the automatic regulation circuit which adjusts the light source for illuminating livestock, and the luminosity of a light source, around-the-clock ** can catch a motion of livestock.

[0032]If it should be proportional to the movement quantity of livestock, when livestock will serve as delivery nearness and will move picture number of sheets violently, while a trifling motion can also catch in a picture, when gentle [ seem ], transmission, preservation, etc. of a useless picture can be prevented. On the contrary, while picture number of sheets can be caught in a picture even if there is a trifling motion when livestock seems to be gentle with illness etc. if it should be in inverse proportion to the movement quantity of livestock, when moving by a healthy state violently, it can be said that transmission, preservation, etc. of a useless picture can be prevented.

[0033]It restricts, when the movement quantity of livestock is below a minimum set value or beyond a maximum set value, and an alarm signal is outputted, then an intense motion and signs that it became quiet of the livestock seen as signs, such as childbirth, can be caught certainly. If such a minimum set value and a maximum set value can be changed, the level which emits an alarm according to a motion of the livestock used as a surveillance object can be changed suitably. If predetermined time passes since the time of the movement quantity of livestock becoming below a minimum set value or beyond a maximum set value and it is made to change an alarm signal, the sound and light which are emitted from an alarm in connection with it can also be changed, and the degree of an alarm can be strengthened according to progress of time. If an alarm signal shall be differed the case below a minimum set value, and in a case of beyond [ a maximum set value ], the state where the sound and light which are emitted from an alarm shall also differ from each other, and livestock moves violently, and a gentle state can be distinguished and known.

[0034]If it is made to carry out the gain adjustment of the storage time of a picture according to the average input value in the whole pixel of an image sensor, an image sensor can be adjusted automatically to input sensitivity suitable for the luminosity of peripheral environment, and around-the-clock ** can catch a motion of livestock. On the other hand, when it has an input sensitivity adjustment device, an image sensor can be manually adjusted to input sensitivity suitable for the luminosity of peripheral environment. If it is made to output an alarm signal not only based on the signal from an image sensor but based on the signal from the odor sensor which detects the bad smell of livestock in order to tell the delivery signs of livestock, that can be told more certainly and correctly.

[0035]The other features and advantages of this invention will become more clear by explanation of the embodiment of the invention given to below with reference to an accompanying drawing.

[0036]

[Embodiment of the Invention]Hereafter, the desirable embodiment of this invention is concretely described with reference to drawings.

[0037]Drawing 1 is a schematic diagram of the delivery supervising system of livestock using it as one embodiment of the livestock monitoring instrument concerning this invention. As shown in this figure, it is for the livestock monitoring instrument A catching the delivery signs of the horse H in a stable (barn), and each livestock monitoring instrument A is installed in the ceiling in a stable, etc. so that a motion of each horse H may be caught. Each livestock monitoring instrument A is connected with the alarm W installed outside the monitoring station or the stable via the common signal cable C1. Each livestock monitoring instrument A is connected with computer-paraphernalia P installed in the monitoring station via the telecommunication cable C2. Although lessons shall be taken from the one horse H and one piece shall correspond for convenience, the livestock monitoring instrument A may be installed in a ceiling, a wall surface, etc. so that they may catch a motion of the horse H from a different angle. [ two or more ] Computer-paraphernalia P is what is called a personal computer etc., and since it is generally known widely, it omits the detailed graphic display explanation. Although the alarm W is provided with the buzzer which emits a warning sound besides red and yellow 2 light type lamp and these are operated according to an input signal, since it is generally constituted by such alarm W based on well-known art, the detailed graphic display explanation is omitted.

[0038]By the way, the horse H serving as delivery nearness, and unlike ******** and a usual situation, composure being lost, and moving about round and round, scratching a ground surface by the nose gear, or striking is known. In the case of a delivery, while a motion becomes quiet comparatively, it is known that the smell of the amniotic liquid which flows out by amniorrhexis etc. will become strong. The livestock monitoring instrument A applied to this embodiment based on such a point regards the characteristic operation seen as signs of childbirth, and a bad smell as a different thing from the time of usual, and it is constituted in order to tell the signs of childbirth certainly promptly from an early stage. Below, the concrete composition of the livestock monitoring instrument A is explained based on drawing 2.

[0039]As drawing 2 is a block diagram showing the internal configuration of the livestock monitoring instrument A and it is shown in this figure, the livestock monitoring instrument A. CPU10, ROM11, RAM12 and EEPROM13 which function as image sensor G, odor sensor S, infrared sensor R, and a control circuit, the interface circuitry 14 which functions as a communication circuit, the light source L, the automatic regulation circuit 15, etc. are provided, and it is constituted. Image sensor G, odor sensor S, infrared sensor R, CPU10, ROM11, RAM12, EEPROM13, the interface circuitry 14, and the automatic regulation circuit 15 are mutually connected by the bus 20. An address bus, a data bus, and a controlling signal line are contained in the bus 20. The signal cable C1 and the telecommunication cable C2 are connected to the interface circuitry 14. The light source L is connected to the automatic regulation circuit 15. The interface circuitry which can communicate between the buses 20 is built in image sensor G, odor sensor S, infrared sensor R, and the automatic regulation circuit 15. Of course, a common interface circuitry may be provided independently separately, without making an interface circuitry build in separately.

[0040]Image sensor G is an artificial retina sensor, for example, and is provided with the function it not only to to catch the picture of the horse H, but to perform image processing at high speed in real time mostly. Speaking concretely, image sensor G's being able to output simultaneously the picture signal which regarded the horse H with a motion, and its background parts as a static object, and the imaging signal which regarded the motion of the horse H as a movement vector based on the optical flow. Such a picture signal is used in order to mainly display a still picture, and an imaging signal is used in order to display an animation or to measure the movement quantity of the horse H. Logic functions [ G / image sensor ], such as edge enhancement and noise rejection, etc. It has a background removing function which removes background parts other than the horse H from a picture signal based on an imaging signal, and a gain-adjustment function which computes an average input value from the whole pixel array used as an acceptance surface, and carries out the gain adjustment of the charge storage time in a pixel array according to this average input value. Although not illustrated in particular, the input sensitivity adjustment mechanism of a knob type switch, a volume switch, or a DIP (Dual Inline Package) type switch for adjusting input sensitivity manually, etc. is provided in image sensor G. According to this, according to the luminosity in a stable, automatic or hand control can adjust the input sensitivity of image sensor G on the optimal level, and around-the-clock ** can catch a motion of the horse H in organization for 24 hours. The image sensor G itself does not provide a function which is already different from a well-known artificial retina sensor in any way.

[0041]Odor sensor S detects smells, such as amniotic liquid emitted when the horse H causes amniorrhexis etc., as a different level from the smell at the time of usual, and is constituted by the semiconductor device which considered the metallic oxide suitable for the bad smell used as a detection object, the additive, etc. as the presentation. The odor sensor S itself does not provide a function which is already different from a well-known odor sensor in any way, and the sensor signal according to the strength of the bad smell is outputted.

[0042]Infrared sensor R detects existence of the horse H in a stable with infrared rays. Which method may be used, although infrared point intensity and point temperature are measured and there are a passive system which detects an object by the relative change, an active system which detects an object by detecting the infrared rays emitted from the light-emitting part in a light sensing portion, etc. as such infrared sensor R. The infrared sensor S itself does not provide a function which is already different from a well-known infrared sensor in any way, and it outputs the sensor signal of ON and OFF according to whether the horse H was detected.

[0043]Although CPU10, ROM11 and RAM12 which function as a control circuit, and EEPROM13 are the microcomputers built into the control board which is not illustrated and not being illustrated in particular, it shall be controlled in supply of a power supply through a control circuit. That is, a microcomputer shall be restricted when the sensor signal of the one which detected the horse H from infrared sensor R is outputted, and it shall operate in response to current supply required for the whole operation from a control circuit. CPU10 controls operation of the whole livestock monitoring instrument A, and ROM11, The program etc. which CPU10 should execute are memorized, RAM12 provides the workspace of CPU10, and the buffer space of data, and EEPROM13 carries out accumulation memory of various kinds of data, information, etc. as a storage device.

[0044]Speaking concretely, CPU10 carrying out the generation output of the alarm signal according to the level of the picture signal from image sensor G and an imaging signal, and also the sensor signal from odor sensor S. This alarm signal shall result in the alarm W eventually through the interface circuitry 14 and the signal cable C1, in the alarm W which received the alarm signal, red and a yellow lamp light up or a warning sound generates it. CPU10 changes a picture signal and an imaging signal into image data and imaging data, and it transmits these data to computer-paraphernalia P through the interface circuitry 14. About image data and imaging data, accumulation memory can also be carried out to EEPROM13. On computer-paraphernalia P, the appearance of the horse H can be checked in real time based on image data and imaging data. It always is not necessary to start computer-paraphernalia P, it is started according to the situation where an alarm is emitted through the above-mentioned alarm W etc., and it may be made to incorporate image data and imaging data from EEPROM13 if needed.

[0045]When it explains still more concretely, CPU10 measures the movement quantity of the horse H based on the imaging signal regarded by image sensor G as a movement vector, and it has the following processings performed based on this movement quantity. For example, CPU10 controls the picture number of sheets obtained in fixed time as image data to become the number of sheets proportional to the movement quantity of the horse H. If according to this the horse H serves as delivery nearness, and moves about or it comes to move the nose gear violently, While the picture number of sheets obtained in fixed time can be increased and a trifling motion can also be regarded as image data, when the horse H begins to give birth and it changes into a comparatively gentle state, The picture number of sheets obtained in fixed time can be lessened, and transmission, preservation, etc. of the almost same contents of useless image data can be prevented.

[0046]CPU10 shall be restricted when the movement quantity of the horse H is below a minimum set value or beyond a maximum set value, and the generation output of the alarm signal shall be carried out. In particular, when the movement quantity is below a minimum set value, it shall restrict, when the sensor signal more than a constant level is acquired from odor sensor S, and shall be outputted in an alarm signal. Although it is memorizable to EEPROM13 as setup information about such a minimum set value and a maximum set value, The preset value variation mechanism of a knob type switch, a volume switch, or a DIP (Dual Inline Package) type switch for a user to change freely a minimum set value and a maximum set value etc. is provided in the control board (graphic display abbreviation). The output level of an alarm signal shall be changed or CPU10 shall differ the output level of an alarm signal by the case where it is beyond the case where the movement quantity of the horse H is below a minimum set value, and a maximum set value, if fixed time passes, since it begins to carry out the generation output of the alarm signal. When the horse H moves violently as a sign in the early stage of childbirth according to this, As a result of measuring that movement quantity beyond with a maximum set value, the alarm signal of for example, the ″L″ level is outputted from the interface circuitry 14, in the alarm W which received this alarm signal, a yellow lamp will light up, for example and the warning sound of small volume will occur. If one of these and time pass, the horse H begins to give birth and it becomes quiet, while the movement quantity will be measured below as for a minimum set value, As a result of detecting the bad smell more than a constant level via odor sensor S, the alarm signal of for example, the ″H″ level is outputted from the interface circuitry 14, in the alarm W which received this alarm signal, a red lamp will light up, for example and Ryo Oto's warning sound will occur. The ″L″ level said here and the ″H″ level are not logical levels.

[0047]The interface circuitry 14 which functions as a communication circuit is for exchanging image data, imaging data, etc. bidirectionally between computer-paraphernalia P via the telecommunication cable C2 while sending out an alarm signal to the alarm W via the signal cable C1. It is for the light source L beginning to illuminate the horse H so that image sensor G may tend to regard the horse H as a movable matter object, and LED, a halogen lamp, etc. are used. Although the automatic regulation circuit 15 in particular is not illustrated, photo detectors, such as a photo-transistor and a photo-diode, detect a surrounding luminosity, The luminosity of the light source L can be automatically adjusted according to the luminosity in a stable, and around-the-clock ** can catch a motion of the horse H certainly via image sensor G with the function of this automatic regulation circuit 15.

[0048]Next, operation of the livestock monitoring instrument A is explained based on a drawing.

[0049]As drawing 3 is a flow chart which shows the livestock monitoring process in the livestock monitoring instrument A and it is shown in this figure, CPU10 judges whether the sensor signal of one is outputted from infrared sensor R (S1).

[0050]Since the horse H exists in a stable when the sensor signal of one is outputted from infrared sensor R (S1:YES), CPU10 drives image sensor G, it incorporates a picture signal and an imaging signal after this, and measures the movement quantity of the horse H based on the imaging signal of them (S2). Since the information about the movement vector of the horse H caught by image sensor G is included in such an imaging signal, CPU10 can ask real time for the movement quantity of the horse H based on a movement vector, without performing complicated image processing. At this time, to the horse H, light shall be emitted from the light source L so that it may become required illumination according to a surrounding luminosity, and image sensor G shall be certainly caught in a motion of the horse H as a movable matter object also in the situation where a luminosity changes with morning, afternoon and night.

[0051]According to the ACK signal which CPU10 transmits a check command to computer-paraphernalia P, and are transmitted from computer-paraphernalia P on the other hand according to it, it is investigated whether it is a state where computer-paraphernalia P can communicate (S3).

[0052]When it is in the state where computer-paraphernalia P can communicate (S3:YES), CPU10 generates image data and imaging data based on the picture signal and imaging signal which were incorporated from image sensor G, and it transmits these data to computer-paraphernalia P (S4). On computer-paraphernalia P which received image data and imaging data, the still picture and animation which caught the horse H based on these data are mostly displayed on real time. Even if it is in the state which computer-paraphernalia P can receive, when the application program corresponding to the display of a still picture or an animation is not started, it is good though image data and imaging data are saved one by one at the hard disk of computer-paraphernalia P, etc.

[0053]In parallel to such data transfer, CPU10 is investigating whether the movement quantity of the horse H obtained in S2 is beyond a maximum set value (S5).

[0054]And when the movement quantity of the horse H becomes in beyond a maximum set value or below a minimum set value (S5:YES), CPU10, It is in the situation which the horse H moves about round and round as a sign in the early stage of childbirth, scratches a ground surface by the nose gear, or is struck, and the situation used as the gentle motion in early stages of a delivery is recognized, and the alarm signal of the "L" level is outputted in order to make the alarm W perform alarm operation according to it (S6). By this, in the alarm W which received the alarm signal of the "L" level, while a yellow lamp lights up as unusual information, a warning sound will occur with comparatively small volume. The movement quantity of the horse H and the output level from odor sensor S are judged synthetically, and it may be made for whether an alarm signal is outputted to determine them. For example, even if the movement quantity of the horse H is beyond a maximum set value and a case below a minimum set value, when there is no output level of odor sensor S more than a constant level, it is good though an alarm signal is not outputted.

[0055]CPU10 investigates whether it is more than the constant level that the output level of odor sensor S in the time defined beforehand (S7).

[0056]When there is no output level of odor sensor S more than a constant level (S7:NO), CPU10 investigates whether the sensor signal of OFF is outputted from infrared sensor R (S8).

[0057]As long as the sensor signal of one is outputted from infrared sensor R, repeat execution of such a series of processings of S2-S8 is carried out (S8:NO), When the sensor signal of OFF is outputted from infrared sensor R (S1:NO, S8:YES), it moves from CPU10 to a standby mode, without performing the main routine of a livestock monitoring process. In this standby mode, it will be in the state of receiving the minimum current supply required in order that current supply may not be performed to image sensor G other than infrared sensor R, odor sensor S, etc. and CPU10 the very thing may also detect the sensor signal of infrared sensor R from a control circuit. That is, when the horse H does not exist in a stable, CPU10 becomes a standby mode and the power consumption of the whole livestock monitoring instrument A can be stopped. In order to stop alarm operations, such as lighting of a lamp, and generating of a warning sound, the operation switch which was formed in the livestock monitoring instrument A and the alarm W and which is not illustrated is turned OFF, and also the livestock monitoring instrument A itself is controlled through computer-paraphernalia P, and it may be made to stop the output of an alarm signal.

[0058]When the output level of odor sensor S is more than a constant level (S7:YES), on the other hand in S7, CPU10, It is recognized as it being in the situation where the horse H began the delivery and became a gentle motion etc., the alarm signal of the "H" level is outputted in order to make the alarm W perform alarm operation according to it (S11), and it progresses to S8 after that. That is, in the alarm W which received the alarm signal of the "H" level, while a red lamp lights up as delivery information, a warning sound will occur with comparatively large volume.

[0059]in S5, even if it is a case where the movement quantity of the horse H does not come out in beyond a maximum set value or below a minimum set value (S5:NO), CPU10 investigates whether it is more than the constant level that the output level of odor sensor S in the time defined beforehand (S10).

[0060]When the output level of odor sensor S is more than a constant level (S10:YES), it is recognized as CPU10 being in the situation where the horse H began the delivery etc., and the alarm signal of the "H" level is outputted in order to make the alarm W perform alarm operation according to it (S11), and it progresses to S8 after that. By this, in the alarm W which received the alarm signal of the "H" level, while a red lamp lights up as delivery information, a warning sound will occur with comparatively large volume.

[0061]In S10, when there is no output level of odor sensor S more than a constant level (S10:NO), he follows CPU10 to S8, without the horse's H recognizing it as it being that it is only in a gentle situation in sleep etc., and outputting an alarm signal.

[0062]In S3, when computer-paraphernalia P cannot communicate (S3:NO), CPU10 saves EEPROM13 the image data and imaging data which were generated based on the picture signal and imaging signal from image sensor G one by one, and it follows them to S5 (S9) and after that. That is, though computer-paraphernalia P was not started or it was started, when it can be physical or data cannot be received on problems, such as a communications program, Storage and preservation of image data and the imaging data can be carried out to EEPROM13, and image data and imaging data can be incorporated by performing access from computer-paraphernalia P according to the required time, a situation, etc.

[0063]Therefore, if the horse H begins the characteristic operation which shows delivery signs according to the livestock monitoring instrument A concerning this embodiment, the picture signal and imaging signal which are different from usual from image sensor G which regarded the horse H as a picture will be outputted, and an alarm signal will be told to the alarm W according to it. That is, since performing characteristic operation used as a sign of a delivery of the horse H if the alarm W is installed in the monitoring station etc. where the horse H to which it is due to give birth separated from the stable which carries out the whereabouts and this alarm W receives an alarm signal is reported by a sound, light, etc., While always not patrolling a barn when giving birth to the horse H and being able to ease a monitoring load, the signs of the delivery can be told at certain and an early stage.

[0064]Since image sensor G can remove background parts other than the horse H without a motion from a picture signal, it can catch the horse H with a motion certainly, and can measure the movement quantity with sufficient accuracy. And since it is considered as signs that the light and the sound which are emitted from the alarm W by the case where it is below the case where the movement quantity of the horse H is beyond a maximum set value, and a minimum set value differ from each other, It not only can know the signs of childbirth promptly from an early stage, but it can distinguish and know the stages at the time of beginning to give birth with such an early stage, etc. Since it is constituted not only based on the picture signal and imaging signal from image sensor G but based on the output level of odor sensor S so that an alarm signal may be outputted in order to tell the delivery signs of the horse H, the signs of childbirth can be told more certainly and correctly.

[0065]This invention is not limited to the above-mentioned embodiment.

[0066]The livestock monitoring instrument A does not have to make image sensor G indispensable, and does not necessarily need to be provided with odor sensor S or infrared sensor R.

[0067]The livestock used as a surveillance object may be not only a horse but a cow etc., and may be quadruped etc. which are bred widely in the zoo etc.

[0068]The livestock monitoring instrument A may be used in order to supervise not only childbirth but the illness of livestock. In this case, CPU10 should just control the picture number of sheets obtained in fixed time as image data to become the number of sheets in inverse proportion to the movement quantity of the horse H. While it can catch in a picture so, then, for example even if the picture number of sheets obtained in fixed time is increased and there is a trifling motion when the horse H seems to be gentle with illness etc., When moving by a healthy state violently, the picture number of sheets obtained in fixed time can be lessened, and transmission, preservation, etc. of the almost same contents of useless image data can be prevented.

[0069]Although the interface circuitry 14 presupposed that various kinds of signals and data are exchanged via the signal cable C1 or the telecommunication cable C2, it is good also as what performs these exchanges on radio. Between the alarm W, computer-paraphernalia P, and the interface circuitry 14, while carrying out central control of various kinds of signals and data, the control device which performs current supply is formed, and the signal and data of these various kinds are put on a power supply line, and may be carried out. Two or more interface circuitries 14 may be formed according to the signal which should be transmitted, or the kind of data.

[0070]CPU10 changes a picture signal and an imaging signal into the video signal of a composite method, and it may be made to transmit this video signal to monitoring devices provided with the composite input terminal through the interface circuitry 14, such as a TV apparatus and a videocassette recorder device.

[0071]As a storage device which memorizes image data and imaging data, others and portability type a memory card, a magneto-optical disc, etc. which are deferred type hard disks etc. may be applied.

[0072]It is not necessary to necessarily provide a microcomputer, image sensor G, etc. which consist of CPU10 etc. in the same control board for example, two or more image sensor G is provided in every place, such as a ceiling and a wall surface, and it may be made for one microcomputer to control these synthetically. The microcomputer as a control circuit is made different from each image sensor G, installs an operator control panel in the inside of a stable, a monitoring station, etc. separately, and may be built into this operator control panel.

[0073]Image sensor G may be an image sensor which is not provided with an image processing function. In this case, what is necessary is just to make CPU10 perform image processing.

[0074]The alarms W may be only what is only provided with one lamp, and a thing provided with one buzzer.

## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is a schematic diagram of the delivery supervising system of livestock using it as one embodiment of the livestock monitoring instrument concerning this invention.

[Drawing 2]It is a block diagram showing the internal configuration of a livestock monitoring instrument.

[Drawing 3]It is a flow chart which shows the livestock monitoring process in a livestock monitoring instrument.

[Description of Notations]

A Each livestock monitoring instrument
W Alarm
P Computer paraphernalia
C1 signal cable
C2 telecommunication cable
H Horse
G Image sensor
S Odor sensor
R Infrared sensor
10 CPU
11 ROM
12 RAM
13 EEPROM
14 Interface circuitry
15 Automatic regulation circuit
L Light source

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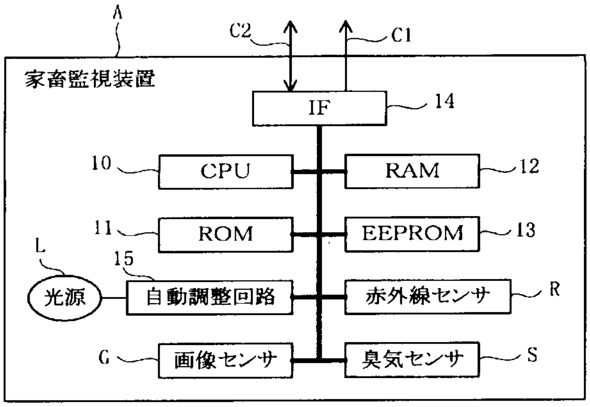
## (54)【発明の名称】　家畜監視装置および家畜の出産監視方法

(57)【要約】

【課題】　家畜の出産などに伴う監視負担を軽減するとともに、その出産などの兆候を確実かつ早期に知らせることができる家畜監視装置を提供する。

【解決手段】　厩舎内における馬の動作に応じて警報を発するための家畜監視装置Ａであって、馬の画像を捉えて処理する画像センサＧと、画像センサＧからの画像信号および撮像信号に応じて警報信号を出力するＣＰＵ１０と、ＣＰＵ１０から出力された警報信号を信号ケーブルＣ１を介して警報器に送り伝えるインターフェイス回路１４とを備える。



【特許請求の範囲】

【請求項１】　畜舎内における家畜の動作に応じて警報を発するための家畜監視装置であって、
上記家畜の画像を捉えて処理する画像センサと、
上記画像センサからの信号に応じて警報信号を出力する制御回路と、
上記制御回路から出力された警報信号を本装置外に送り伝える通信回路と、
を備えることを特徴とする、家畜監視装置。

【請求項２】　上記画像センサは、上記家畜を移動物体として特定し得る撮像信号と、上記家畜を静止物体として特定し得る画像信号とを出力する、請求項１に記載の家畜監視装置。

【請求項３】　上記画像センサからの上記撮像信号および／または上記画像信号を、本装置外のコンピュータ装置に撮像データおよび／または画像データとして送信するためのインターフェイス回路を備える、請求項２に記載の家畜監視装置。

【請求項４】　上記画像センサからの上記撮像信号および／または上記画像信号を、撮像データおよび／または画像データとして本装置内に記憶しておくためのストレージデバイスを備える、請求項２または３に記載の家畜監視装置。

【請求項５】　上記画像センサからの上記撮像信号および／または上記画像信号を、本装置外のモニタ装置に映像信号として送信するためのインターフェイス回路を備える、請求項２ないし４のいずれかに記載の家畜監視装置。

【請求項６】　本装置外へと無線により信号またはデータを送信する無線ユニットを備える、請求項１ないし５のいずれかに記載の家畜監視装置。

【請求項７】　上記画像センサは、上記撮像信号に基づいて上記画像信号から上記家畜以外の背景部分を除去する、請求項２ないし６のいずれかに記載の家畜監視装置。

【請求項８】　上記畜舎内の天井および／または壁面に複数個取り付けられる、請求項１ないし７のいずれかに記載の家畜監視装置。

【請求項９】　上記家畜を赤外線により検知する赤外線センサを備える、請求項１ないし８のいずれかに記載の家畜監視装置。

【請求項１０】　上記家畜を照らすための光源を備える、請求項１ないし９のいずれかに記載の家畜監視装置。

【請求項１１】　上記光源の明るさを周辺の明るさに応じて調整する自動調整回路を備える、請求項１０に記載の家畜監視装置。

【請求項１２】　上記画像信号に基づいて順次得られる画像枚数は、上記撮像信号に基づいて計測される上記家畜の動き量に比例または反比例する、請求項２ないし１１のいずれかに記載の家畜監視装置。

【請求項１３】　上記制御回路は、上記撮像信号に基づいて計測される上記家畜の動き量が最小設定値以下あるいは最大設定値以上の場合に限り、上記警報信号を出力する、請求項２ないし１２のいずれかに記載の家畜監視装置。

【請求項１４】　上記制御回路には、上記最小設定値および最大設定値を変更するための設定値変更手段が設けられている、請求項１３に記載の家畜監視装置。

【請求項１５】　上記制御回路は、上記家畜の動き量が上記最小設定値以下あるいは最大設定値以上となった時点から所定時間が経過すると、上記警報信号を変化させる、請求項１３または１４に記載の家畜監視装置。

【請求項１６】　上記制御回路は、上記家畜の動き量が上記最小設定値以下の場合と最大設定値以上の場合とで上記警報信号を異なるものとする、請求項１３ないし１５のいずれかに記載の家畜監視装置。

【請求項１７】　上記画像センサの画素全体から平均入力値を算出するとともに、この平均入力値に応じて画像の蓄積時間をゲイン調整するゲイン調整手段を有する、請求項１ないし１６のいずれかに記載の家畜監視装置。

【請求項１８】　上記画像センサの入力感度を調整するための入力感度調整手段を有する、請求項１ないし１７のいずれかに記載の家畜監視装置。

【請求項１９】　上記家畜の臭気を検知する臭気センサを備え、
上記制御回路は、上記画像センサおよび上記臭気センサからの両信号に基づいて、上記家畜の出産兆候を伝えるべく上記警報信号を出力する、請求項１ないし１８のいずれかに記載の家畜監視装置。

【請求項２０】　請求項１ないし１９のいずれかに記載の家畜監視装置を用いて、家畜が出産兆候にある旨を警報により知らせることを特徴とする、家畜の出産監視方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、たとえば厩舎で飼育される馬や牛、広くは動物園などで飼育されている動物などの家畜を監視するための技術に関し、特に、家畜の出産兆候を捉えるのに優れた家畜監視装置および家畜の出産監視方法に関する。

【０００２】

【従来の技術】たとえば、競走馬は、馬種の改良、畜産の振興を目的として飼育されるが、すぐれた疾走能力を発揮するのに必要な体型・体質・気質が要求され、特定の馬種同士を交配して生み出されるのが一般的とされている。このような競走馬の出産には、種付け費用などの相当な投資が伴うことから、確実かつ安全であることが要求され、そのため、出産時期には、厩務員が連日２４時間体制で牝馬の監視を行うものとされている。

【０００３】ところで、常に牝馬を監視するには相当な負担が強いられ、また、出産予定日よりも早い時期や遅れた時期に分娩が始まることもあることから、厩舎内にビデオカメラを取り付け、このビデオカメラで捉えた牝馬の挙動を監視所のモニタ装置に映し出して監視するようにしているところもある。また、最近においては、分娩に伴う特有の臭気を検知して監視所に出産間近である旨を報知するといったシステムを採用しているところもある。これにより、厩務員は、出産の兆候が現れるまで監視所で待機することができ、幾分負担が軽減されている。

【０００４】

【発明が解決しようとする課題】しかしながら、ビデオカメラおよびモニタ装置を用いて監視する体制としても、厩務員は、定期的あるいは常に監視所のモニタ装置を通じて牝馬の様子をうかがわなければならず、厩務員にとって監視負担が完全に払拭されるというわけではなかった。

【０００５】一方、分娩に伴う臭気を検知して出産間近である旨を報知するシステムでは、破水などによって流出する羊水の臭いを検知することができるが、羊水流出などが起こるまでは、出産間近となって発せられる臭気の強さと平常時の臭気の強さとにほとんど差がないため、早期段階における出産の兆候を見逃すおそれがある。また、空気中を漂う臭気を検知対象とするために、牝馬以外の臭いにも反応して誤作動を引き起こすおそれがあり、これらの点から確実かつ早期に出産の兆候を捉えることができないという難点があった。

【０００６】なお、上記した装置やシステムは、競走馬の出産に限らず、狭義の家畜としての馬や牛、さらに広く解釈すれば、動物園などで飼育されている動物などに関して出産や病気などを監視するためにも適用できるが、いずれにしても先述したような問題が生じるものとされる。

【０００７】

【発明の開示】本発明は、上記した事情のもとで考え出されたものであって、家畜の出産などに伴う監視負担を軽減するとともに、その出産などの兆候を確実かつ早期に知らせることができる家畜監視装置、および家畜の出産監視方法を提供することを、その課題とする。

【０００８】上記の課題を解決するため、本発明では、次の技術的手段を講じている。

【０００９】すなわち、本発明の第１の側面によれば、畜舎内における家畜の動作に応じて警報を発するための家畜監視装置であって、家畜の画像を捉えて処理する画像センサと、画像センサからの信号に応じて警報信号を出力する制御回路と、制御回路から出力された警報信号を本装置外に送り伝える通信回路とを備えることを特徴とする、家畜監視装置が提供される。

【００１０】好ましい実施の形態によれば、画像センサは、家畜を移動物体として特定し得る撮像信号と、家畜を静止物体として特定し得る画像信号とを出力する。

【００１１】他の好ましい実施の形態によれば、画像センサからの撮像信号および／または画像信号を、本装置外のコンピュータ装置に撮像データおよび／または画像データとして送信するためのインターフェイス回路を備える。

【００１２】さらに他の好ましい実施の形態によれば、画像センサからの撮像信号および／または画像信号を、撮像データおよび／または画像データとして本装置内に記憶しておくためのストレージデバイスを備える。

【００１３】さらに他の好ましい実施の形態によれば、画像センサからの撮像信号および／または画像信号を、本装置外のモニタ装置に映像信号として送信するためのインターフェイス回路を備える。

【００１４】さらに他の好ましい実施の形態によれば、本装置外へと無線により信号またはデータを送信する無線ユニットを備える。

【００１５】さらに他の好ましい実施の形態によれば、画像センサは、撮像信号に基づいて画像信号から家畜以外の背景部分を除去する。

【００１６】さらに他の好ましい実施の形態によれば、畜舎内の天井および／または壁面に複数個取り付けられる。

【００１７】さらに他の好ましい実施の形態によれば、家畜を赤外線により検知する赤外線センサを備える。

【００１８】さらに他の好ましい実施の形態によれば、家畜を照らすための光源を備える。

【００１９】さらに他の好ましい実施の形態によれば、光源の明るさを周辺の明るさに応じて調整する自動調整回路を備える。

【００２０】さらに他の好ましい実施の形態によれば、画像信号に基づいて順次得られる画像枚数は、撮像信号に基づいて計測される家畜の動き量に比例または反比例する。

【００２１】さらに他の好ましい実施の形態によれば、制御回路は、撮像信号に基づいて計測される家畜の動き量が最小設定値以下あるいは最大設定値以上の場合に限り、警報信号を出力する。

【００２２】さらに他の好ましい実施の形態によれば、制御回路には、最小設定値および最大設定値を変更するための設定値変更手段が設けられている。

【００２３】さらに他の好ましい実施の形態によれば、制御回路は、家畜の動き量が最小設定値以下あるいは最大設定値以上となった時点から所定時間が経過すると、警報信号を変化させる。

【００２４】さらに他の好ましい実施の形態によれば、制御回路は、家畜の動き量が最小設定値以下の場合と最大設定値以上の場合とで警報信号を異なるものとする。

【００２５】さらに他の好ましい実施の形態によれば、

画像センサの画素全体から平均入力値を算出するとともに、この平均入力値に応じて画像の蓄積時間をゲイン調整するゲイン調整手段を有する。

【００２６】さらに他の好ましい実施の形態によれば、画像センサの入力感度を調整するための入力感度調整手段を有する。

【００２７】さらに他の好ましい実施の形態によれば、家畜の臭気を検知する臭気センサを備え、制御回路は、画像センサおよび臭気センサからの両信号に基づいて、家畜の出産兆候を伝えるべく警報信号を出力する。

【００２８】また、本発明の第２の側面によれば、上記家畜監視装置を用いて、家畜が出産兆候にある旨を警報により知らせることを特徴とする、家畜の出産監視方法が提供される。

【００２９】つまり、本発明によれば、家畜が出産兆候などを示す特有の動作を始めると、その家畜を画像として捉えた画像センサから通常とは異なる信号が出力され、それに応じて警報信号が装置外に伝えられる。したがって、装置外となる監視所などに警報器を設置しておき、この警報器が警報信号を受信すると、家畜の出産兆候などが音や光などによって報知されるので、家畜の出産などに際して常に厩舎を見回る必要もなく監視負担を軽減できるとともに、その出産などの兆候を確実かつ早期に知らせることができる。

【００３０】また、画像センサは、撮像信号および画像信号を出力するものとすれば、出産などの前兆として見られる家畜の動きを普段とは異なるものとして確実に捉えることができる。コンピュータ装置に撮像データや画像データを送信すれば、コンピュータ装置上でほぼリアルタイムに家畜の動きを確認することができる。ストレージデバイスに撮像データや画像データを記憶しておけば、コンピュータ装置を常に起動しておかなくても、必要に応じて撮像データや画像データを取り出し、定期的に家畜の動きを確認することができる。モニタ装置に映像信号を送信すれば、そのモニタ装置を介してほぼリアルタイムに家畜の動きを確認することができる。このような信号やデータを無線により送信するものとすれば、配線の手間を省くことができる。

【００３１】また、画像センサは、動きの無い家畜以外の背景部分を除去するといった、移動物体抽出機能を備えたものとすれば、動きのある家畜を確実に捉えることができる。本装置を畜舎内の天井や壁面に複数個取り付けておけば、仮に一方の装置で家畜の動きを正確に捉えることができない状況にあっても、他方の装置側から家畜の動きを正確に捉えることができる。家畜を赤外線センサにより検知するようにすれば、この赤外線センサが家畜を検知している間に限り画像センサを作動させて省電力化を図ることができる。家畜を照らすための光源や、光源の明るさを調整する自動調整回路を備えたものとすれば、昼夜を問わずに家畜の動きを捉えることができる。

【００３２】また、画像枚数を家畜の動き量に比例したものとすれば、家畜が出産間近となって激しく動く際、些細な動きも画像に捉えることができる一方、おとなしい様子の際には、無駄な画像の転送や保存などを防ぐことができる。逆に、画像枚数を家畜の動き量に反比例したものとすれば、家畜が病気などでおとなしい様子の際、些細な動きがあっても画像に捉えることができる一方、健康な状態で激しく動く際には、無駄な画像の転送や保存などを防ぐことができると言える。

【００３３】また、家畜の動き量が最小設定値以下あるいは最大設定値以上の場合に限り警報信号を出力するとすれば、出産などの前兆として見られる家畜の激しい動きやおとなしくなった様子を確実に捉えることができる。このような最小設定値および最大設定値を変更できるとすれば、監視対象となる家畜の動きに応じて警報を発するレベルを適当に変更することができる。家畜の動き量が最小設定値以下あるいは最大設定値以上となった時点から所定時間が経過すると、警報信号を変化させるようにすれば、それに伴い警報器から発せられる音や光も変化させることができ、時間の経過に応じて警報の度合いを強めることができる。最小設定値以下の場合と最大設定値以上の場合とで警報信号を異なるものとすれば、警報器から発せられる音や光も異なるものとすることができ、家畜が激しく動く状態と、おとなしい状態とを区別して知ることができる。

【００３４】また、画像センサの画素全体における平均入力値に応じて画像の蓄積時間をゲイン調整するようにすれば、画像センサを周辺環境の明るさに適した入力感度に自動調整でき、昼夜を問わずに家畜の動きを捉えることができる。一方、入力感度調整手段を有する場合には、画像センサを周辺環境の明るさに適した入力感度に手動で調整することができる。画像センサからの信号のみならず、家畜の臭気を検知する臭気センサからの信号にも基づいて、家畜の出産兆候を伝えるべく警報信号を出力するようにすれば、その旨をより確実かつ正確に知らせることができる。

【００３５】本発明のその他の特徴および利点は、添付図面を参照して以下に行う発明の実施の形態の説明によって、より明らかになるであろう。

【００３６】

【発明の実施の形態】以下、本発明の好ましい実施の形態を、図面を参照して具体的に説明する。

【００３７】図１は、本発明に係る家畜監視装置の一実施形態として、それを用いた家畜の出産監視システムの概要図である。この図に示すように、家畜監視装置Ａは、厩舎（畜舎）内における馬Ｈの出産兆候を捉えるためのものであって、各家畜監視装置Ａは、各馬Ｈの動きを捉えるように厩舎内の天井などに設置されている。各家畜監視装置Ａは、共通の信号ケーブルＣ１を介して監

視所や厩舎外に設置された警報器Wと接続されている。また、各家畜監視装置Ａは、通信ケーブルＣ２を介して監視所に設置されたコンピュータ装置Ｐと接続されている。なお、家畜監視装置Ａは、便宜上、一頭の馬Ｈにつき１個が対応するものとするが、異なる角度から馬Ｈの動きを捉えるべく、天井や壁面などに複数個設置しても良い。また、コンピュータ装置Ｐは、いわゆるパーソナルコンピュータなどであって一般に広く知られていることから、その詳細な図示説明を省略する。さらに、警報器Wは、赤および黄の２灯式ランプのほか、警報音を発するブザーを備え、これらを入力信号に応じて動作させるものであるが、このような警報器Wについても一般に周知の技術に基づいて構成されることから、その詳細な図示説明を省略する。

【００３８】ところで、馬Ｈは、出産間近となって産気づくと、普段の様子とは異なり落ち着きが無くなってぐるぐると動き回ったり、前脚で地面を掻いたり叩いたりすることが知られている。また、分娩の際には、比較的動きがおとなしくなるとともに、破水などによって流出する羊水の臭いが強まることが知られている。このような点を踏まえて本実施形態に係る家畜監視装置Ａは、出産の兆候として見られる特有の動作や臭気を平常時とは異なるものとして捉え、出産の兆候を早期段階からいち早く確実に知らせるために構成されたものである。以下に、家畜監視装置Ａの具体的な構成について図２に基づいて説明する。

【００３９】図２は、家畜監視装置Ａの内部構成を示すブロック図であって、この図に示すように、家畜監視装置Ａは、画像センサＧ、臭気センサＳ、赤外線センサＲ、制御回路として機能するＣＰＵ１０、ＲＯＭ１１、ＲＡＭ１２、およびＥＥＰＲＯＭ１３、通信回路として機能するインターフェイス回路１４、ならびに、光源Ｌや自動調整回路１５などを具備して構成されている。画像センサＧ、臭気センサＳ、赤外線センサＲ、ＣＰＵ１０、ＲＯＭ１１、ＲＡＭ１２、ＥＥＰＲＯＭ１３、インターフェイス回路１４、および自動調整回路１５は、バス線２０により相互に接続されている。バス線２０には、アドレスバス、データバス、および制御信号線が含まれる。インターフェイス回路１４には、信号ケーブルＣ１および通信ケーブルＣ２が接続されている。自動調整回路１５には、光源Ｌが接続されている。なお、画像センサＧ、臭気センサＳ、赤外線センサＲ、および自動調整回路１５には、バス線２０との間で通信可能なインターフェイス回路が内蔵されている。もちろん、インターフェイス回路を個々に内蔵させずに、別途共通のインターフェイス回路を独立して設けても良い。

【００４０】画像センサＧは、たとえば人工網膜センサであって、馬Ｈの画像を単に捉えるだけでなく、画像処理をほぼリアルタイムで高速に行う機能を備える。具体的に言うと、画像センサＧは、動きのある馬Ｈとその背景部分とを静止物体として捉えた画像信号と、オプティカルフローに基づいて馬Ｈの動きを移動ベクトルとして捉えた撮像信号とを同時に出力することができる。このような画像信号は、主として静止画像を表示するために用いられ、撮像信号は、動画を表示したり馬Ｈの動き量を計測したりするために用いられる。また、画像センサＧは、輪郭強調やノイズ除去などといったロジック機能のほか、撮像信号に基づいて画像信号から馬Ｈ以外の背景部分を除去する背景除去機能や、受光面となる画素アレイ全体から平均入力値を算出し、この平均入力値に応じて画素アレイにおける電荷蓄積時間をゲイン調整するゲイン調整機能を備える。特に図示しないが、画像センサＧには、入力感度を手動で調整するためのつまみ型スイッチ、ボリュームスイッチ、あるいはＤＩＰ（Dual Inline Package ）型スイッチなどといった入力感度調整機構が設けられている。これによれば、厩舎内の明るさに応じて画像センサＧの入力感度を自動あるいは手動で最適レベルに調整することができ、昼夜を問わずに２４時間体制で馬Ｈの動きを捉えることができる。なお、画像センサＧそのものは、すでに周知の人工網膜センサと何ら異なる機能を提供するものではない。

【００４１】臭気センサＳは、馬Ｈがたとえば破水などを起こしたときに発する羊水などの臭いを、平常時の臭いとは異なるレベルとして検知するものであって、検知対象となる臭気に適した金属酸化物や添加物などを組成とした半導体素子により構成されている。なお、臭気センサＳそのものも、すでに周知の臭気センサと何ら異なる機能を提供するものではなく、臭気の強さに応じたセンサ信号を出力するものである。

【００４２】赤外線センサＲは、厩舎内における馬Ｈの存在を赤外線により検知するものである。このような赤外線センサＲとしては、赤外線の点強度や点温度を測定し、その相対的変化により物体を検知するパッシブ方式や、発光部から発した赤外線を受光部にて検出することで物体を検知するアクティブ方式などがあるが、いずれの方式でも良い。なお、赤外線センサＳそのものも、すでに周知の赤外線センサと何ら異なる機能を提供するものではなく、馬Ｈを検知したか否かに応じてオン／オフのセンサ信号を出力するものである。

【００４３】制御回路として機能するＣＰＵ１０、ＲＯＭ１１、ＲＡＭ１２、およびＥＥＰＲＯＭ１３は、図示しない制御基板に組み込まれたマイクロコンピュータであって、特に図示しないが電源制御回路を通じて電源の供給が制御されるものとされている。つまり、マイクロコンピュータは、赤外線センサＲから馬Ｈを検知したオンのセンサ信号が出力される場合に限り、電源制御回路から全体の動作に必要な電源供給を受けて動作するものとされる。ＣＰＵ１０は、家畜監視装置Ａ全体の動作を制御し、ＲＯＭ１１は、ＣＰＵ１０が実行すべきプログラムなどを記憶し、ＲＡＭ１２は、ＣＰＵ１０の作業領

域やデータのバッファ領域を提供し、ＥＥＰＲＯＭ１３は、ストレージデバイスとして各種のデータや情報などを蓄積記憶するものである。

【００４４】具体的に言うと、ＣＰＵ１０は、画像センサＧからの画像信号および撮像信号、さらには臭気センサＳからのセンサ信号のレベルに応じて警報信号を生成出力する。この警報信号は、インターフェイス回路１４および信号ケーブルＣ１を経て最終的に警報器Ｗに至るものとされ、警報信号を受信した警報器Ｗでは、赤や黄色のランプが点灯したり警報音が発生する。また、ＣＰＵ１０は、画像信号および撮像信号を画像データおよび撮像データに変換し、これらのデータをインターフェイス回路１４を通じてコンピュータ装置Ｐへと送信する。画像データおよび撮像データについては、ＥＥＰＲＯＭ１３に蓄積記憶しておくこともできる。コンピュータ装置Ｐ上では、画像データおよび撮像データに基づいてリアルタイムで馬Ｈの様子を確認できる。なお、コンピュータ装置Ｐは、常に起動しておく必要はなく、上記した警報器Ｗを通じて警報が発せられる状況などに応じて起動し、必要に応じてＥＥＰＲＯＭ１３から画像データおよび撮像データを取り込むようにしても良い。

【００４５】さらに具体的に説明すると、ＣＰＵ１０は、移動ベクトルとして画像センサＧで捉えた撮像信号に基づいて馬Ｈの動き量を計測し、この動き量に基づいて以下の処理を行うものとされる。たとえば、ＣＰＵ１０は、画像データとして一定時間内に得られる画像枚数を、馬Ｈの動き量に比例した枚数となるように制御する。これによれば、馬Ｈが出産間近となって動き回ったり前脚を激しく動かすようになると、一定時間内に得られる画像枚数を多くして些細な動きも画像データとして捉えることができる一方、馬Ｈが分娩し始めて比較的おとなしい状態となった際には、一定時間内に得られる画像枚数を少なくしてほとんど同じ内容の無駄な画像データの転送や保存などを防ぐことができる。

【００４６】また、ＣＰＵ１０は、馬Ｈの動き量が最小設定値以下あるいは最大設定値以上の場合に限り、警報信号を生成出力するものとされる。特に、その動き量が最小設定値以下の場合には、臭気センサＳから一定レベル以上のセンサ信号が得られる場合に限り、警報信号が出力されるものとされる。このような最小設定値および最大設定値については、設定情報としてＥＥＰＲＯＭ１３に記憶しておくことができるが、最小設定値および最大設定値をユーザが自由に変更するためのつまみ型スイッチ、ボリュームスイッチ、あるいはＤＩＰ（Dual Inline Package ）型スイッチなどといった設定値変更機構が制御基板に設けられている（図示省略）。さらに、ＣＰＵ１０は、警報信号を生成出力し始めてから一定時間が経過すると、警報信号の出力レベルを変化させたり、馬Ｈの動き量が最小設定値以下の場合と最大設定値以上の場合とで警報信号の出力レベルを異なるものとする。

これによれば、出産の早期段階における前兆として馬Ｈが激しく動く際には、その動き量が最大設定値以上と計測される結果、インターフェイス回路１４からたとえば「Ｌ」レベルの警報信号が出力され、この警報信号を受信した警報器Ｗにおいては、たとえば黄色のランプが点灯して小音量の警報音が発生することとなる。その一方、時間が経過して馬Ｈが分娩し始めておとなしくなると、その動き量が最小設定値以下と計測されるとともに、臭気センサＳを介して一定レベル以上の臭気が検知される結果、インターフェイス回路１４からたとえば「Ｈ」レベルの警報信号が出力され、この警報信号を受信した警報器Ｗにおいては、たとえば赤色のランプが点灯して大音量の警報音が発生することとなる。なお、ここで言う「Ｌ」レベル、「Ｈ」レベルは、論理レベルのことではない。

【００４７】通信回路として機能するインターフェイス回路１４は、信号ケーブルＣ１を介して警報器Ｗに警報信号を送出するとともに、通信ケーブルＣ２を介してコンピュータ装置Ｐとの間で画像データや撮像データなどを双方向にやり取りするためのものである。光源Ｌは、画像センサＧが馬Ｈを移動物体として捉えやすいように、馬Ｈを照らし出すためのものであって、ＬＥＤやハロゲンランプなどが用いられる。自動調整回路１５は、特に図示しないがフォトトランジスタやフォトダイオードなどの受光素子により周辺の明るさを検出し、光源Ｌの明るさを厩舎内の明るさに応じて自動的に調整するものであって、この自動調整回路１５の機能により昼夜を問わずに馬Ｈの動きを画像センサＧを介して確実に捉えることができる。

【００４８】次に、家畜監視装置Ａの動作について図面に基づいて説明する。

【００４９】図３は、家畜監視装置Ａにおける家畜監視処理を示すフローチャートであって、この図に示すように、ＣＰＵ１０は、赤外線センサＲからオンのセンサ信号が出力されているか否かを判断している（Ｓ１）。

【００５０】赤外線センサＲからオンのセンサ信号が出力される場合（Ｓ１：ＹＥＳ）、厩舎内に馬Ｈが存在するため、ＣＰＵ１０は、画像センサＧを駆動してこれから画像信号および撮像信号を取り込み、そのうちの撮像信号に基づいて馬Ｈの動き量を計測する（Ｓ２）。このような撮像信号には、画像センサＧによって捉えられた馬Ｈの移動ベクトルに関する情報が含まれることから、ＣＰＵ１０は、複雑な画像処理を行うことなく移動ベクトルに基づいて馬Ｈの動き量をリアルタイムに求めることができる。このとき、馬Ｈに対しては、周辺の明るさに応じて必要な照度となるように光源Ｌから光が発せられ、朝昼晩によって明るさが変化する状況でも、移動物体としての馬Ｈの動きを画像センサＧが確実に捉えることができるものとされる。

【００５１】その一方、ＣＰＵ１０は、コンピュータ装

置Ｐに対してチェックコマンドを送信し、それに応じてコンピュータ装置Ｐから送信されてくるＡＣＫ信号などに応じてコンピュータ装置Ｐが通信可能な状態か否かを調べる（Ｓ３）。

【００５２】コンピュータ装置Ｐが通信可能な状態の場合（Ｓ３：ＹＥＳ）、ＣＰＵ１０は、画像センサＧから取り込んだ画像信号および撮像信号に基づいて画像データおよび撮像データを生成し、これらのデータをコンピュータ装置Ｐに対して転送する（Ｓ４）。画像データおよび撮像データを受信したコンピュータ装置Ｐ上では、これらのデータに基づいて馬Ｈを捉えた静止画像や動画がほぼリアルタイムに表示される。なお、コンピュータ装置Ｐが受信可能な状態であっても、静止画像や動画の表示に対応するアプリケーションプログラムが起動されていないときには、コンピュータ装置Ｐのハードディスクなどに画像データおよび撮像データが順次保存されるとしても良い。

【００５３】このようなデータ転送に並行してＣＰＵ１０は、Ｓ２にて得られた馬Ｈの動き量が最大設定値以上か否かを調べている（Ｓ５）。

【００５４】そして、馬Ｈの動き量が最大設定値以上、または最小設定値以下となった場合（Ｓ５：ＹＥＳ）、ＣＰＵ１０は、出産の早期段階における前兆として馬Ｈがぐるぐると動き回ったり、前脚で地面を掻いたり叩いたりする状況であり、また分娩の初期のおとなしい動きとなった状況を認識し、それに応じた警報動作を警報器Ｗに実行させるべく「Ｌ」レベルの警報信号を出力する（Ｓ６）。これにより、「Ｌ」レベルの警報信号を受信した警報器Ｗでは、異常報知として黄色のランプが点灯するとともに、比較的小さい音量で警報音が発生することとなる。なお、警報信号を出力するか否かは、馬Ｈの動き量と臭気センサＳからの出力レベルとを総合的に判断して決定するようにしても良い。たとえば、馬Ｈの動き量が最大設定値以上や最小設定値以下の場合であっても、臭気センサＳの出力レベルが一定レベル以上にない場合には、警報信号を出力しないとしても良い。

【００５５】また、ＣＰＵ１０は、その時点での臭気センサＳの出力レベルがあらかじめ定めた一定レベル以上か否かを調べる（Ｓ７）。

【００５６】臭気センサＳの出力レベルが一定レベル以上にない場合（Ｓ７：ＮＯ）、ＣＰＵ１０は、赤外線センサＲからオフのセンサ信号が出力されるか否かを調べる（Ｓ８）。

【００５７】このようなＳ２～Ｓ８の一連の処理は、赤外線センサＲからオンのセンサ信号が出力されている限り繰り返し実行され（Ｓ８：ＮＯ）、赤外線センサＲからオフのセンサ信号が出力される場合（Ｓ１：ＮＯ，Ｓ８：ＹＥＳ）、ＣＰＵ１０は、家畜監視処理のメインルーチンを実行することなく待機モードに移る。この待機モードでは、赤外線センサＲ以外の画像センサＧや臭気センサＳなどに対して電源供給が行われず、また、ＣＰＵ１０自体も赤外線センサＲのセンサ信号を検出するために必要な最小限の電源供給を電源制御回路から受けるだけの状態となる。つまり、馬Ｈが厩舎内に存在しない場合には、ＣＰＵ１０が待機モードとなって家畜監視装置Ａ全体の消費電力を抑えることができる。なお、ランプの点灯や警報音の発生といった警報動作を停止させるには、家畜監視装置Ａや警報器Ｗに設けられた図示しない操作スイッチをオフにするほか、コンピュータ装置Ｐを通じて家畜監視装置Ａ自体を制御して警報信号の出力を中止させるようにしても良い。

【００５８】一方、Ｓ７において、臭気センサＳの出力レベルが一定レベル以上の場合（Ｓ７：ＹＥＳ）、ＣＰＵ１０は、馬Ｈが分娩を始めておとなしい動きとなった状況などにあると認識し、それに応じた警報動作を警報器Ｗに実行させるべく「Ｈ」レベルの警報信号を出力し（Ｓ１１）、その後Ｓ８に進む。つまり、「Ｈ」レベルの警報信号を受信した警報器Ｗでは、出産報知として赤色のランプが点灯するとともに、比較的大きい音量で警報音が発生することとなる。

【００５９】また、Ｓ５において、馬Ｈの動き量が最大設定値以上、または最小設定値以下でない場合であっても（Ｓ５：ＮＯ）、ＣＰＵ１０は、その時点での臭気センサＳの出力レベルがあらかじめ定めた一定レベル以上か否かを調べる（Ｓ１０）。

【００６０】臭気センサＳの出力レベルが一定レベル以上の場合（Ｓ１０：ＹＥＳ）、ＣＰＵ１０は、馬Ｈが分娩を始めた状況などにあると認識し、それに応じた警報動作を警報器Ｗに実行させるべく「Ｈ」レベルの警報信号を出力し（Ｓ１１）、その後Ｓ８に進む。これにより、「Ｈ」レベルの警報信号を受信した警報器Ｗでは、出産報知として赤色のランプが点灯するとともに、比較的大きい音量で警報音が発生することとなる。

【００６１】Ｓ１０において、臭気センサＳの出力レベルが一定レベル以上にない場合（Ｓ１０：ＮＯ）、ＣＰＵ１０は、馬Ｈが単に睡眠中などでおとなしい状況にあるだけと認識し、警報信号を出力することなくＳ８に進む。

【００６２】Ｓ３において、コンピュータ装置Ｐが通信不可の場合（Ｓ３：ＮＯ）、ＣＰＵ１０は、画像センサＧからの画像信号および撮像信号に基づいて生成した画像データおよび撮像データを、順次ＥＥＰＲＯＭ１３に保存し（Ｓ９）、その後Ｓ５に進む。つまり、コンピュータ装置Ｐが起動されていなかったり、起動されていたとしても物理的あるいは通信プログラムなどの問題でデータを受信できない場合、画像データおよび撮像データをＥＥＰＲＯＭ１３に蓄積保存しておくことができ、必要な時や状況などに応じてコンピュータ装置Ｐからアクセスを行うことで画像データおよび撮像データを取り込むことができる。

【００６３】したがって、本実施形態に係る家畜監視装置Ａによれば、馬Ｈが出産兆候を示す特有の動作を始めると、その馬Ｈを画像として捉えた画像センサＧから通常とは異なる画像信号および撮像信号が出力され、それに応じて警報信号が警報器Ｗに伝えられる。つまり、出産予定の馬Ｈが所在する厩舎から離れた監視所などに警報器Ｗを設置しておき、この警報器Ｗが警報信号を受信すると、馬Ｈが出産の兆しとなる特有の動作を行っていることが音や光などによって報知されるので、馬Ｈの出産に際して常に畜舎を見回る必要もなく監視負担を軽減できるとともに、その出産の兆候を確実かつ早期に知らせることができる。

【００６４】また、画像センサＧは、動きの無い馬Ｈ以外の背景部分を画像信号から除去することができるので、動きのある馬Ｈを確実に捉えることができ、その動き量を精度良く計測することができる。しかも、馬Ｈの動き量が最大設定値以上の場合と最小設定値以下の場合とで警報器Ｗから発せられる光や音が異なる様子とされるので、出産の兆候を早期段階からいち早く知ることができるだけでなく、そのような早期段階と分娩し始めた際などの段階とを区別して知ることができる。さらに、画像センサＧからの画像信号や撮像信号だけでなく、臭気センサＳの出力レベルにも基づいて、馬Ｈの出産兆候を伝えるべく警報信号を出力するように構成されているので、出産の兆候をより確実かつ正確に知らせることができる。

【００６５】なお、本発明は、上記実施形態に限定されるものではない。

【００６６】家畜監視装置Ａは、画像センサＧを必須とするものであって、必ずしも臭気センサＳや赤外線センサＲを備える必要はない。

【００６７】監視対象となる家畜は、馬に限らず牛などであっても良く、広くは動物園などで飼育されている四足獣などであっても良い。

【００６８】また、家畜監視装置Ａは、出産に限らず家畜の病気を監視するために利用しても良い。この場合、ＣＰＵ１０は、画像データとして一定時間内に得られる画像枚数を、馬Ｈの動き量に反比例した枚数となるように制御すれば良い。そうすると、たとえば馬Ｈが病気などでおとなしい様子の際、一定時間内に得られる画像枚数を多くして些細な動きがあっても画像に捉えることができる一方、健康な状態で激しく動く際には、一定時間内に得られる画像枚数を少なくしてほとんど同じ内容の無駄な画像データの転送や保存などを防ぐことができる。

【００６９】インターフェイス回路１４は、信号ケーブルＣ１や通信ケーブルＣ２を介して各種の信号やデータをやり取りするとしたが、これらのやり取りを無線で行うものとしても良い。また、警報器Ｗやコンピュータ装置Ｐとインターフェイス回路１４との間には、各種の信号やデータを集中管理するとともに電源供給を行う制御装置を設け、これら各種の信号やデータを電源供給線に載せてやり取りさせても良い。さらに、インターフェイス回路１４は、伝送すべき信号やデータの種類に応じて複数設けられていても良い。

【００７０】ＣＰＵ１０は、画像信号および撮像信号をコンポジット方式の映像信号に変換し、この映像信号をインターフェイス回路１４を通じてコンポジット入力端子を備えたテレビジョン装置やビデオデッキ装置などのモニタ装置へと送信するようにしても良い。

【００７１】画像データや撮像データを記憶しておくストレージデバイスとしては、据置型のハードディスクなどのほか、可搬型のメモリカードや光磁気ディスクなどを適用しても良い。

【００７２】ＣＰＵ１０などからなるマイクロコンピュータや画像センサＧなどは、必ずしも同一の制御基板に設ける必要はなく、たとえば複数の画像センサＧを天井や壁面などの各所に設け、これらを１つのマイクロコンピュータが総合的に制御するようにしても良い。また、制御回路としてのマイクロコンピュータは、各画像センサＧとは別にして厩舎内や監視所などに制御盤を別途設置し、この制御盤に組み込まれたものであっても良い。

【００７３】画像センサＧは、画像処理機能を備えないイメージセンサであっても良い。この場合、画像処理をＣＰＵ１０に実行させればよい。

【００７４】警報器Ｗは、単に１つのランプを備えるだけのものや、１つのブザーを備えるだけのものであっても良い。

【図面の簡単な説明】

【図１】本発明に係る家畜監視装置の一実施形態として、それを用いた家畜の出産監視システムの概要図である。

【図２】家畜監視装置の内部構成を示すブロック図である。

【図３】家畜監視装置における家畜監視処理を示すフローチャートである。

【符号の説明】

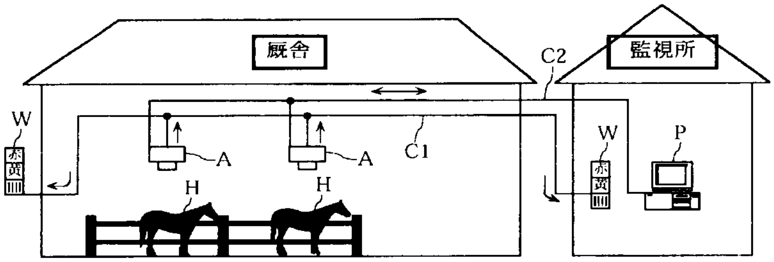
| | |
|---|---|
| Ａ | 各家畜監視装置 |
| Ｗ | 警報器 |
| Ｐ | コンピュータ装置 |
| Ｃ１ | 信号ケーブル |
| Ｃ２ | 通信ケーブル |
| Ｈ | 馬 |
| Ｇ | 画像センサ |
| Ｓ | 臭気センサ |
| Ｒ | 赤外線センサ |
| １０ | ＣＰＵ |
| １１ | ＲＯＭ |
| １２ | ＲＡＭ |
| １３ | ＥＥＰＲＯＭ |

１４　インターフェイス回路

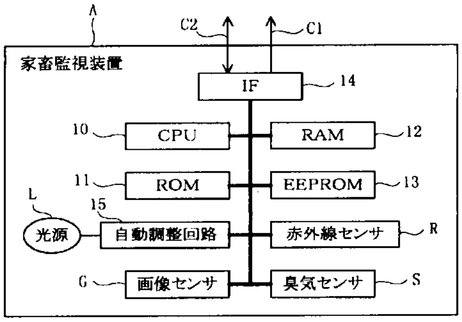
１５　自動調整回路

Ｌ　光源

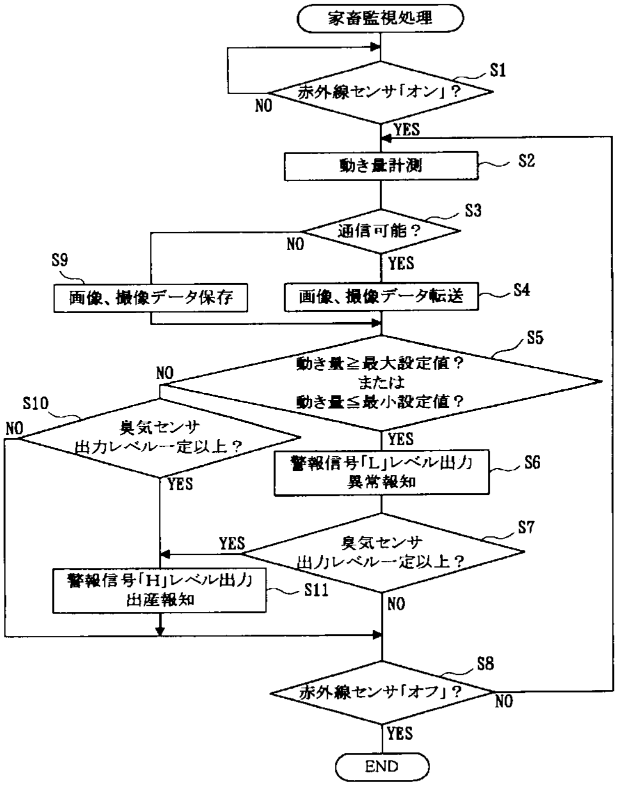
【図１】



【図２】



【図３】



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フロントページの続き

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# (54) IMAGE MONITORING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To solve the problem that a conventional method can not follow a dynamic change such as a sunlight condition of an area to be monitored, resulting in false detection and failure in detection of an intruding object.

SOLUTION: An object which moves fast is detected on the basis of a rapidly updated luminance difference between a reference image and a monitored image, an object which moves at a low speed is detected by using an averaging monitored image, and an object which is silhouetted by a silhouette object detecting means is detected

when a reflected state is discriminated by an environment analyzing means.

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## CLAIMS

[Claim(s)]
[Claim 1]An image monitor comprising:
An image input means.
Two or more object detection means according to movement speed.
A detection object selecting means which unifies a detection result by said two or more object detection techniques.
An object tracing means to pursue an object sorted out by said detection object selecting means over a multiple frame, and an invading object judging means judged to be detection of an invading object when it is able to pursue by said object tracing means beyond a predetermined distance.

[Claim 2]An image monitor comprising:
An image input means.
Two or more object detection means according to movement speed.
A silhouette object detection means which detects a silhouette-like object.
A detection object selecting means which unifies a detection result by said two or more object detection means and a silhouette object detection means, An object tracing means to pursue an object sorted out by said detection object selecting means over a multiple frame, and an invading object judging means judged to be detection of an invading object when it is able to pursue by said object tracing means beyond a predetermined distance.

[Claim 3]An image monitor comprising:
An image input means.

An object detection means which detects a non-silhouette object.

A silhouette object detection means which detects a silhouette-like object.

A detection object selecting means which unifies a detection result by said object detection means and a silhouette object detection means, An object tracing means to pursue an object sorted out by said detection object selecting means over a multiple frame, and an invading object judging means judged to be detection of an invading object when it is able to pursue by said object tracing means beyond a predetermined distance.

[Claim 4]An image monitor forming an environmental analysis means and sorting out by said detection object selecting means in any 1 paragraph of claims 1 thru/or 3 according to an analysis result of said environmental analysis means.

[Claim 5]An image monitor, wherein an analysis result of said environmental analysis means is displayed in claim 4.

[Claim 6]An image monitor, wherein a sorting state of said detection object selecting means is displayed in claim 4.

[Claim 7]An image monitor, wherein a hitcher on operates and sorts out said detection object selecting means in any 1 paragraph of claims 1 thru/or 6.

[Claim 8]Any 1 paragraph of claims 1 thru/or 7 characterized by comprising the following.

The amount measurement means of fluctuation which measures a luminance change of a background image of a monitor area.

An invading object detection means to bring about a luminance change beyond a measurement luminance change by said fluctuation measurement means.

An invading object detection means to bring about a luminance change below a measurement luminance change by said fluctuation measurement means.

[Claim 9]Claim 8 comprising:

The amount measurement means of fluctuation which measures the amount of fluctuation of a background image of a monitor area.

A fluctuation image creating means which creates a reference image containing fluctuation which updated promptly and was created in order to incorporate fluctuation below the amount of measurement fluctuation by said amount measurement means of fluctuation.

A mobile detection means of a high speed and usual speed which comprises an object detection means considered as object detection with detection of a field with luminance difference of said reference image containing fluctuation, and monitor images.

[Claim 10]An image monitor repealing an object detection means which detects an invading object which brings about a luminance change beyond a measurement luminance change by said fluctuation measurement means to a field which measures luminosity change of a background image in a monitor area, and is changed in claim 8 or 9 more sharply than a predetermined luminosity change.

[Claim 11]In [ have an object detection means considered as object detection in any 1 paragraph of claims 4 thru/or 10 with detection of a field which has the change beyond predetermined luminance difference to a reference image of a monitor area, and ] said object detection means, An image monitor abandoning pursuit by making into a noise a detection object which is less than a predetermined size after measuring a size of a detection object.

[Claim 12]An image monitor possessing an environmental analysis means to judge whether the number of a noise generated in said object detection means is calculated in claim 11, and it is operating under environment in which said object detection means tends to carry out erroneous detection.

[Claim 13]Claim 12 comprising:

An object detection means by a different technique.

An environmental analysis means to calculate the number of a noise generated in an object detection means by said different technique for said every object detection means, and to judge the object detection technique of having been suitable for the present environment, from said counting result.

[Claim 14]An image monitor possessing a low speed and a standstill object detection means which a degree of a spatial change of luminosity uses a field more than a predetermined size as an invading object in any 1 paragraph of claims 1 thru/or 13 with monitor images which carried out the luminance average of several frames of a monitor area for every pixel.

[Claim 15]It has a reference image which averages and creates a time series picture of a monitor area for every pixel over a multiple frame in claim 14, An image monitor possessing a low speed and a standstill object detection means which a degree of a spatial change of luminosity appoints a field more than a predetermined size at an invading object detection invalid zone with said reference image.

[Claim 16]An image monitor providing a low speed and a standstill object detection means of creating said reference image for every fixed time, in claim 15.

[Claim 17]In any 1 paragraph of claims 1 thru/or 16, hold an averaging picture which carried out averaging of the time series picture of a monitor area, and a field more than predetermined luminosity within said averaging picture is received, An image monitor possessing a silhouette object detection means which will make this an invading object if a field below the second predetermined luminosity is detected.

[Claim 18]In claim 17, a field more than said predetermined luminosity of said averaging picture is received, When an invading object does not exist, detect a field below the second predetermined luminosity, create a binary picture of this field and fields other than this, and said binary picture is held as a reference image, An image monitor possessing a silhouette object detection means which makes a field below said second predetermined luminosity an invading object detection invalid zone by said binary picture.

[Claim 19]An image monitor providing a silhouette object detection means which creates said reference image periodically in claim 18.

[Claim 20]In any 1 paragraph of claims 1 thru/or 19, an object detected for every frame is compared by inter-frame, An image monitor possessing an object tracing means to choose a portion which makes a movement vector the move direction and a size of this object inter-frame [ said ], is based on a size of said movement vector, and represents a position of said object at the time of next inter-frame collation.

[Claim 21]In claim 20, when said movement vector is below a predetermined size, The circumscribed rectangle center of an object at the time of inter-frame collation is made into a representation position of said object, An image monitor possessing an object tracing means which makes an intersection with an outline of a line segment lengthened in said direction of a movement vector from the circumscribed rectangle center of said object when said movement vector was larger than a predetermined size, and said object, or said circumscribed rectangle outline a representation position of said object.

[Claim 22]An image monitor comprising a computer provided with an image input interface and an image display interface in any 1 paragraph of claims 1 thru/or 21.

[Claim 23]An image monitor using an infrared camera as a TV camera in any 1 paragraph of claims 1 thru/or 22.

[Claim 24]An image monitor having an infrared irradiation device in claim 23.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the image monitor which detects a motion of an invading object selectively and reports it in a scene with motions, such as a scene which starts the image monitor which detects and supervises a supervisory object in a background with a motion, especially has motions, such as a wave of the water surface, and reflection, and fluctuation of trees.

[0002]

[Description of the Prior Art]As an image monitor, if an invading object is detected in a surveillance object field, many devices which report existence of an invading object to a hitcher on are introduced. As a conventional image monitor, there are a camera with a preset feature, an infrared sensor, a monitor, and an image monitor that comprises a recording device, for example.

[0003]The camera with a preset feature is a TV camera which can control direction and magnifying power of a field angle, and is a camera which has a function which memorizes direction of the field angle of two or more places, and the combination of magnifying power beforehand, and can be chosen at any time. An infrared sensor opposes an infrared irradiation part and light sensing portion, is installed, and is considered as detection of the invading object with detection of an invading object interrupting infrared rays through between an irradiation part and light sensing portions.

[0004]An infrared sensor is formed in 1 in a surveillance object field, or several places, and direction and magnifying power of the field angle of a camera with a preset feature are doubled with the position of said infrared sensor. Detection of an invading object of one of the infrared sensors will carry out operation which records the picture which this was interlocked with, and direction and magnifying power of the field angle were chosen, and was caught with said camera with a preset feature with a recording device.

[0005]By the invention of a statement, to JP,2000-209571,A. With the composition which added the image processing device to the above-mentioned conventional-type image monitor, the infrared sensor detected the invading object, the picture containing an invading object was processed with the image processing device, and the field angle and magnifying power of a camera with a preset feature are determined according to change of luminosity.

[0006]The image processing device was comprised, the picture of the camera was processed with the image processing device, the motion in a surveillance object field was detected, this motion portion is recorded as an invading object, or the invention given in JP,11-45379,A has reported to the hitcher on that they are a camera, a recording device, and a monitor.

[0007]The picture of the surveillance object field where an invading object does not exist in JP,11-355764,A by the invention of a statement is held as a reference image, the luminosity of the current image and reference image of a surveillance object field is measured, and the portion which produces luminance difference is detected as an invading object. The field angle and magnifying power of a camera are determined that the position of an invading object will come to a center.

[0008]

[Problem(s) to be Solved by the Invention]However, in the invention given in an above-mentioned conventional-type image monitor and JP,2000-209571,A, detection of an invading object is possible only at the place in which the infrared sensor in a surveillance object field is installed, and it has the first technical problem that an invading object is undetectable at places other than this.

[0009]If the wave of the water surface, reflection, the branches and leaves of trees, etc. use the invention of a statement for JP,11-45379,A and JP,11-355764,A in the scene in which a motion serves as a backdrop, Even when an invading object does not exist, the second technical problem that these motions in a surveillance object field are accidentally detected with an invading object occurs.

[0010]By the way, if a marine vessel navigates, a wake behind a sailing ship will generate on the ocean behind this marine vessel. A wake behind a sailing ship is conspicuous in a marine vessel being a high speed, and it appears, and, moreover, reaches by several times the size of a marine vessel. When the invention of a statement is applied to JP,11-45379,A and JP,11-355764,A in the above situations, the wake behind a sailing ship of this marine vessel is regarded as an invading object, and the third technical problem that only a wake behind a sailing ship is recorded also on a recording picture occurs.

[0011]The purpose of this invention is to provide the image monitor which can detect an invading object with sufficient accuracy, without carrying out erroneous detection of the motion to backgrounds, such as a wave of the water surface, reflection, and branches and leaves of trees.

[0012]Other purposes of this invention measure invading object's existence coordinates correctly, and there are in providing the image processing device which can turn the field angle of a camera to these coordinates.

[0013]

[Means for Solving the Problem]A picture of a surveillance object field is processed as the first aspect of this invention for solving the first technical problem, It is considered as an invading object candidate with local luminance difference with a reference image, several frames are covered and said invading object candidate is pursued, and after checking that beyond a predetermined distance had moved, it judges as an invading object, and it reports to a hitcher on or records on a recording device.

[0014]If the surveillance object field whole region is stored in a field angle of a television camera by the above composition, it will become detectable [ an invading object ] throughout a surveillance object field. First of all, after some invading objects move, you may report in many cases, and it becomes possible by taking the first aspect to catch an invading object which moves, without reacting to branches and leaves, reciprocating movement of a flag, and fluctuation of the water surface.

[0015]As what is added to the same composition as the first aspect as the second aspect of this invention for solving the second technical problem, As said reference image, it has two or more reference images, and according to [ for detection ] is provided with an image monitor detecting an invading object based on local luminance difference of each reference image and surveillance object region image.

[0016]Since it is the reference image in which the first reference image in two or more reference images is a reference image updated promptly enough using a surveillance object region image of several frame past from one frame, and fluctuation of a wave or trees was also incorporated, It is hard to produce luminance difference based on fluctuation of a wave or trees, and while it is rare to carry out erroneous detection of the fluctuation of these waves or trees to an invading object, if an invading object crosses a surveillance object field at a certain amount of speed, luminance difference arises between reference images and said invading object can be detected to it.

[0017]however, a wave and trees which swing when an invading object invades at an extraordinary low speed -- said -- an invading object will also be incorporated into the first reference image like, and there is a problem that a low-speed invading object cannot be caught. In order to solve this problem, the second reference image is used, and the second reference image is obtained by carrying out averaging of the past several frames by predetermined load. If averaging of several frames is carried out, while fluctuation of a wave or trees will be equalized and a time luminosity change will be offset, a stationary rock and a building become the good reference image of contrast carried out distinctly.

[0018]If averaging of from several past of a picture of a surveillance object field to the present frame is carried out by predetermined load as monitor images, while a time jitter of luminosity by fluctuation of a wave or trees is offset, An invading object which is moving at a low speed or is standing it still becomes the good monitor images of contrast carried out distinctly. If local luminance difference of the second reference image and monitor images by averaging is searched for, an invading object can be detected without catching fluctuation of a wave or trees.

[0019]However, in monitor images by averaging, an object which moves at high speed tends to fade, and it is hard to detect it. Then, it is desirable to detect an invading object more than a certain speed, and to detect an invading object below speed which is the second reference image with the first reference image.

[0020]A reflected light detection means and a silhouette object detection means are established as what is added to the same composition as the second aspect as the third aspect of this invention for solving the second technical problem.

[0021]Object detection processing based on the first reference image and the second reference image is locally cancelled temporarily to an invader object candidate's field noting that an invader object candidate is reflection of the sun etc., i.e., catoptric light, when luminosity of a reflected light detection means of a field detected as an invading object candidate is higher than predetermined luminosity. That is, a mask of object detection processing is temporarily carried out to an invader object candidate's field.

[0022]Thus, if an invading object exists in a field to which catoptric light exists, unless an invading object is a powerful photogen, an object part will certainly be in a silhouette state smeared away black. Then, if an invading object which changed into a silhouette state is detected by a silhouette object detection means, even if an invading object is in a field cancelled temporarily about object detection processing based on the first reference image and the second reference image, it will be possible to detect this and, moreover, erroneous detection of the catoptric light will not be carried out to an invading object.

[0023]Thus, if the third aspect is used, when sources of intensive light, such as the sun, reflect on the water surface, catoptric light can move according to fluctuation of a wave, and a problem that a local difference arises and erroneous detection arises between the first reference image and monitor images can be solved.

[0024]It has which composition of the third aspect from the first as the fourth aspect of this invention for solving the third technical problem, When pursuing an invading object candidate, speed or the move direction of an invading object candidate is measured, report a portion containing an outline by the side of an invading object candidate's move direction to a hitcher on as an invading object candidate's position, it records, or a field angle and magnifying power of another camera are doubled. By the above tracking processing, even if a wake behind a sailing ship remains after an invading object, the invading object itself can be caught exactly.

[0025]Video obtained from a camera consists of a series of a still picture, and every sheet of a still picture which is this series picture will be called a frame in this specification. Video of a television camera of standard NTSC specification is constituted by per second about 30 frames.

[0026]

[Embodiment of the Invention]An embodiment of the invention is described with reference to drawings. Although an intruding ship monitoring instrument on the ocean is explained as an example below, this invention is not restricted to this.

[0027]Drawing 13 is an example of the embodiment of the image monitor of this invention. In drawing 13, the camera 1301 and the camera 1302 are installed in the support 1303 fixed to the quay or the seaside building 1304. The camera 1301 can change direction with the angle adjustment device 1306, or can change magnifying power. The camera 1302 has set up the field angle cover the whole surveillance object field.

[0028]A hitcher on can view the image of the camera 1301 via the monitor 1305, and it can be recorded on the recording device 1308. Although not illustrated by the angle adjustment device 1306, the recording device 1308, and the monitor 1305, the interface of MAMMASHIN exists, A hitcher on can control the field angle of the camera 1301 manually via this man machine interface, and said surveillance object field can be viewed via the monitor 1305. The image of the camera 1301 can be recorded on the recording device 1308 if needed.

[0029]If the image processing device of this invention is made into automatic mode, the image processing device 1305 will process the image of the camera 1302, If the intruding ship 1312 exists in a surveillance object field, this will be detected and the automatic control of the field angle and magnifying power of the camera 1301 will be carried out via the angle adjustment device 1306 according to the detection position of the intruding ship 1312.

[0030]The image processing device 1305 is reported to a hitcher on via the informing device 1307 while it controls the recording device 1308 and records the picture of the camera 1301. A hitcher on is told by the informing means 1307. Methods, such as a sound and blink of light, can be taken as a method of telling about.

[0031]The monitor 1310 is formed, it may enable it to check the image of the camera 1302, the recording device 1308 is formed, and it may enable it to record the image of the camera 1302. It always records on the recording device 1308 using what has a function in which overwrite recording is possible, and if recording operation is suspended with the output of the image processing device 1305, before the intruding ship 1312 invades, it can leave the image of an immediately after [ invasion ] from from.

[0032]It is not necessary to necessarily install the camera 1301 and the camera 1302 in the same support.

[0033]If the surveillance object field whole region is stored in the field angle of a television camera by taking the above composition, there is an effect which becomes detectable [ an invading object ] throughout a surveillance object field. First of all, after some invading objects move, you may report in many cases, and there is an effect it becomes possible to catch the invading object which moves by taking above voice, without reacting to branches and leaves, reciprocating movement of a flag, and fluctuation of the water surface.

[0034]Next, the second example of the image monitor of this invention is described. Make the second example of the image monitor of this invention the same composition as the first example, and the composition of the image processing device 1305, As shown in drawing 1, the image input means 101 and the time series picture holding mechanism 102, With the averaging image creating means 103, at high speed and usually The moving body detecting means 104 of speed, The silhouette object detection means 105, a low speed and the standstill object detection means 106, the detection object selecting means 107, the environmental analysis means 108, the object tracing means 109, the invading object judging means 110, and the displaying means 111 are comprised.

[0035]The image input means 101 captures and carries out analog-to-digital conversion of the picture of the camera 1302. The time series picture holding mechanism 102 holds two or more pictures of a time series. The averaging image creating means 103 carries out averaging of the picture of the time series picture holding mechanism 102 by predetermined load, and creates an addition picture. The moving body detecting means 104 of speed swings from the time series picture of the time series picture holding mechanism 102, and at high speed and usually creates and holds an entering reference image.

[0036]It swings, and it is a reference image which incorporates and updates fluctuation of backgrounds, such as a wave and a grove, and an entering reference image is a reference image which eliminated the change accompanied by a bigger luminosity change than fluctuation of a background. The field more than a value predetermined in the luminance difference of the high speed and newest **** in which time series picture holding mechanism usually holds the moving body detecting means 104 of speed, and said background image containing fluctuation is outputted as an invading object candidate. The binary picture data which carried out binarization of an invading object candidate area and the other field may be sufficient as an output form, and the circumscribed rectangle coordinates of this invading object candidate area may be sufficient as it.

[0037]It classifies into a high speed and the portion which is not usually so intense as the intense portion of fluctuation by distribution of the luminance difference of the averaging picture of the averaging image creating means 103, and the newest **** of the time series picture holding mechanism 102 as for the moving body detecting means 104 of speed. Although it swung with the newest ****, the predetermined value was made into the threshold for luminance difference with an entering background image and the invading object candidate is detected, The possibility of the erroneous detection of the invading object by fluctuation of a wave or a grove is also reducible by making said threshold variable in the intense portion of fluctuation, and the portion which is not intense, for example, making a threshold high in the intense portion of fluctuation. However, this is not indispensable.

[0038]By the way, an invading object will be silhouette-ized if an invading object exists between a camera and light sources, such as the sun. At this time, the high-intensity field of reflection according [ the image of a camera ] to a light source exists, and silhouette-ization of this invading object is seen as a low luminance area in a high-intensity field.

[0039]The silhouette object detection means 105 has the function to detect this silhouette-ized invading object. [ the silhouette object detection means 105 reflects the field more than a predetermined luminosity threshold in the averaging picture of the averaging image creating means 103, considers that it is a field, and / in said reflection field of the newest **** of the time series picture holding mechanism 102 ], It detects as an invading object candidate who silhouette-ized the field below the luminosity threshold for silhouette detection.

[0040]A low-speed object and the standstill object detection means 106 detect the large field of the spatial luminance change of the averaging picture of the averaging image creating means 103 as a candidate of a low-speed object or a standstill object.

[0041]The moving body detecting means 104 of three object candidate detection means, i.e., a high speed, explained above and usual speed, Since the silhouette object detection means 105, and a low-speed object and the standstill object detection means 106 change invading object detection capacity by the height of the movement speed of an invading object, the existence of reflection of a surveillance object field, etc., if these are used together and combined, it will become an effective monitoring instrument.

[0042]The detection object selecting means 107 unifies a high speed and the detection result usually according to the moving body detecting means 104, the silhouette object detection means 105, and the low-speed object and the standstill object detection means 106 of speed, respectively.

[0043]The image monitor of this invention can set up the function of the detection object selecting means 107 according to operational environment. For example, in the employment which stations the hitcher on who concentrates on surveillance business, the detection object selecting means 107 is manually operated by a hitcher's on judgment, A high speed and the detection result usually according to the moving body detecting means 104, the silhouette object detection means 105, and the low-speed object and the standstill object detection means 106 of speed can be repealed, respectively, or it can validate. At this time, the logical sum of the result of each technique will be carried out an effective detection object.

[0044]The environmental analysis means 108 may be formed, the environment of a surveillance object field may be judged, and the effective invalid change of each detection result in the detection object selecting means 107 may be automated.

[0045]The displaying means 111 can display the operation situation of the environmental analysis means 108, and can display the analysis result of a surveillance object field, and the selected result of the detection object selecting means 107. When a hitcher on operates the detection object selecting means 107 manually, the environmental analysis result which the displaying means 111 displays can also be referred to.

[0046]By the detection object selecting means 107, the object tracing means 109 covers a multiple frame, and pursues the detection object which became effective. The invading object judging means 110 judges whether it is a noise according whether a pursuit object is an invading object to fluctuation etc. based on the tracking result of the object tracing means 109, and considers the result as the output of the image processing device 1305.

[0047]In addition to the ability to suppress substantially malfunctioning in branches and leaves, reciprocating movement of a flag, and fluctuation of the water surface by taking the above composition, an invading object with few motions than fluctuation of these backgrounds and the invading object which changed into the silhouette state by the backlight can also be caught with sufficient sensitivity. There is an effect used as the system which is easy to grasp an operation situation and is easy to treat by displaying the analysis result of the environmental analysis means 108 for a hitcher on.

[0048]The monitoring instrument of this invention is possible also for realizing by computer provided with the image acquisition interface and the signal output interface, and becomes a flow of the processing shown in drawing 2.

[0049]In drawing 2, the memory area for each parameter and picture storing is initialized (Step 1). In addition to the ability to prevent malfunction by this, it puts into invading object detecting operation promptly after a surveillance cycle start. When the existence of interruption of an end instruction is checked and a termination interrupt is after a surveillance cycle start, processing is ended, and when there is no termination interrupt, it shifts to Step 3 (Step 2).

[0050]The picture of a surveillance object field is acquired via an image acquisition interface (Step 3). It updates by the picture acquired at Step 3, holding the time series picture of required number of sheets (Step 4). The averaging picture of the time series picture by the present is updated (Step 5).

[0051]A speedy craft valid flag, a silhouette valid flag, and a low-speed ship valid flag are formed, and effective beforehand at initial setting of Step 1 or invalidity is set up. If the speedy craft valid flag is effective, movable matter object detection processing of a speedy craft and usual speed will be performed (Step 6). If the silhouette valid flag is effective, silhouette object detection processing will be performed (Step 7). If the low-speed ship valid flag is effective, a low speed and standstill object detection processing will be performed (Step 8). Processing of Step 6 thru/or Step 8 may be performed in any order, without restricting in order of drawing 2.

[0052]In environmental analysis processing, the bad weather of a wave and a white cap stand from the size and the number of the invading object candidate by the luminosity, Step 6, or Step 8 of an average addition picture, judge condition and the existence of reflection, and The validity of the valid flag of Step 6 thru/or Step 8, "Invalidity" is set up or the height of the threshold of invading object candidate detection of Step 6 thru/or Step 8 is controlled (Step 9). When carrying out image acquisition of these flags and the threshold again, the following surveillance cycle 3, i.e., step, and performing Steps 6 thru/or 8, they become effective.

[0053]When the average luminance of the partial area of an averaging picture is larger than a predetermined value as an example of the environmental analysis of Step 9, it judges with the backlight state suitable for a light source, and the detection system of Step 6 which is easy to carry out erroneous detection by reflection is halted, or the camera 1302 raises a detection threshold and dulls sensitivity.

[0054]In the state of such a backlight, since an invading object changes in the shape of a silhouette, it raises the sensitivity of the detection system of Step 7. When the **** office detected by the detection system of Step 6 has many, i.e., a noise, which do not result by the judgment of an invading object, While judging it as the state where a wave is ruined and many white caps stand, weakening the sensitivity of Step 6 and reducing the possibility of erroneous detection, in order to detect the object which hides in waves and invades at a low speed, the sensitivity of the processing which detects the low-speed ship of Step 8 is maintained.

[0055]In object tracing processing (Step 10), the position and the feature of the invading object candidate who detected in the pre-surveillance cycle are held beforehand, the position and the feature of the invading object candidate who detected in the present surveillance cycle are compared, and this invading object candidate's movement state is measured. Collation of the invading object candidate between such surveillance cycles is performed by calculating the distance in which this invading object candidate is located between surveillance cycles, and considering that the invading object candidate by the side of these days is the same invading object candidate's movement, when one or more invading object candidates are detected, for example in each surveillance cycle.

[0056]When an invading object candidate's sizes differ greatly between surveillance cycles, and when distance is large, it can also remove from the candidate of collation. The similarity of this invading object candidate's luminance distribution can also be measured and compared by pattern matching processing. Change of the speed to a previous frame can also be compared so that it may become the minimum.

[0057]In display processing (Step 11), the result of the environmental analysis of Step 9 can be displayed if needed, or the operation situation of Step 6 thru/or Step 8 can be displayed, or when an invading object exists in a surveillance object field, it can surround and express as a frame. In invading object decision processing (Step 12), it judges with an invading object from said invading object candidate's pursuit situation, Make the camera 1301 follow with the angle adjustment device 1306 through a signal output interface, the informing means 1307 reports to a hitcher on, or the image of an invading object is recorded with the recording device 1308.

[0058]Next, it results in the image acquisition of Step 3 through the check of a termination interrupt at Step 2, and a surveillance cycle is repeated.

[0059]It is effective in an invading object being always detectable using the calculation speed of the newest personal computer by the flow of processing in case the above carries out the image processing device 1305 by computer.

[0060]Next, "the moving body detecting means 104 of a high speed and usual speed" is called the detection means 104 for short, and the details of the first example of the detection means 104 are explained based on drawing 3.

[0061]In drawing 3, with the amount measurement means 301 of fluctuation, the detection means 104 swings and comprises the entering reference image preparing means 302, the detection invalid zone setting-out means 303, the object detection means 304, and the detection object effective invalid judging means 305. A basic principle catches the luminance change of the picture of said surveillance object field which holds the picture of the surveillance object field where an invading object does not exist as a reference image, and is produced with an objective invasion, and detects an invading object.

[0062]However, for preventing erroneous detection under the background for which a wave, trees, etc. swing, it is necessary to incorporate fluctuation into a reference image. Since the amount of fluctuation which should be incorporated changes every moment, it needs to measure this change and needs to adjust the amount of taking in of fluctuation automatically.

[0063]The detection means 104 is carrying out composition which realizes this, and the amount measurement means 301 of fluctuation measures the amount of luminosity change of the swinging field in several frames to the newest frame of the time series picture holding mechanism 102.

[0064]As an example of measurement of the amount of fluctuation, as shown in drawing 4, it swings, and the quantity observation windows 401 thru/or 404 are formed. Drawing 4 is the picture on the ocean caught with the camera 1302, drawing 4 (a) is a picture of the surveillance object field of the newest frame, and drawing 4 (b) is a picture of the surveillance object field of several frame past.

[0065]For example, in order to measure the amount of change of the luminosity by the swinging wave, it swings to four places and the quantity observation windows 401 thru/or 404 are formed. The luminosity in the fluctuation observation window 401 is changed for fluctuation of a wave, and if the newest frame and drawing 4 (b) take a part for luminance difference with several frame past picture and drawing 4 (a) carries out binarization with a predetermined threshold, it will become a picture of drawing 5 (a).

[0066]Since the luminance change for every frame will become large if it will be in the fluctuating state of fluctuation, if binarization is carried out with a predetermined threshold, the area of difference will become like drawing 5 (b) greatly from drawing 5 (a). Since the luminance change for every frame will decrease if it will be in the state with little fluctuation of a wave, if binarization is carried out with a threshold predetermined [ this ], the area of difference will become like drawing 5 (c) few from drawing 5 (a).

[0067]The area of a binary ghost object becomes small like drawing 5 (c), so that the area of a binary ghost object is so large like drawing 5 (b) that fluctuation of a wave becomes large when a threshold is fixed so that the above explanation may show and fluctuation of a wave is small.

[0068]A binarization threshold is enlarged when larger than both fixed number values whose area of a binary ghost object is two about the area of a binary ghost object as compared with two fixed number values, By making a binarization threshold small, when smaller than both fixed number values whose area of a binary ghost object is two, the area of a binary object can be maintained at the fixed range, and the size of a threshold can be fluctuated according to the size of fluctuation of a wave.

[0069]That is, if fluctuation of a wave becomes large, as for a threshold, the portion from which it becomes large and result inter-frame luminosity changes a lot will also become is hard to be detected as a binary object. If fluctuation of a wave becomes small, a threshold will become small and will become that it is easy to be detected as a binary ghost object also in a portion with few result inter-frame luminance changes.

[0070]Here, the output of the amount measurement means 301 of fluctuation presupposes that it is a binarization threshold for carrying out area of the binary ghost object in the amount observation window 401 thru/or 404 of fluctuation near [ predetermined ] the value. When a respectively different threshold is obtained from the amount observation windows 401 thru/or 404 of fluctuation, the average value of four thresholds can also be made into a final threshold, and the median can also be taken. Henceforth, it swings and this is called a threshold.

[0071]It swings, and the entering reference image preparing means 302 swings using the time series picture of the time series picture holding mechanism 102, and creates an entering reference image. Specifically, let the newest **** of camera 1302 acquisition be said reference image containing fluctuation in initial setting (Step 1). For every continuing surveillance cycle, the luminance difference part picture of the newest **** of the time series picture holding mechanism 102 and said reference image containing fluctuation is created, and binarization is carried out with a fluctuation threshold. The binary object detected at this time is a field which produces a bigger luminosity change than fluctuation of the wave in the amount observation window 401 thru/or 404 of fluctuation.

[0072]On the other hand, except this field, rather than fluctuation of the wave in the amount observation window 401 thru/or 404 of fluctuation, it is a field with little luminosity change, and it restricts to this field, and swings by the luminance distribution of the newest ****, and an entering reference image is updated.

[0073]By the above processing, it swings and an entering reference image turns into a reference image of entering [ which incorporated the change below fluctuation of the wave in the amount observation window 401 thru/or 404 of fluctuation ] fluctuation.

[0074]By the object detection means's 304 swinging with the newest image of the time series picture holding mechanism 102, creating a luminance difference part picture with the reference image of the entering reference image preparing means 302, and carrying out binarization with a predetermined threshold, The portion which produces a bigger luminosity change than fluctuation of the wave in the amount observation window 401 thru/or 404 of fluctuation is detectable as a binary ghost object.

[0075]The detection object effective invalid judging means 305 sets up the circumscribed rectangle of a binary ghost object, measures a size, and outputs the binary ghost object of the predetermined range as an invading object candidate. By taking the above composition, it can respond to change of the amount of fluctuation of a background promptly, can adjust automatically to it, and is effective in the ability of